Perennials — A Retrospective

The best of The Green Thumb magazine

Mountain, Plain and Garden

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Continuous Borders

by Rose Sudmeier

A knowledgeable and enthusiastic gardener, Rose Sudmeier was active in Home Garden Club of Denver, an independent garden club with 300 members – and a waiting list. This article probably was written as a result of a talk she gave to the club, which may have prompted the chairman of DBG's editorial committe, Katherine Bruderlin Crisp, to solicit it for The Green Thumb *magazine.*

["Continuous Borders" by Rose Sudmeier originially appeared in The Green Thumb *magazine, Vol. 20, No. 6 (Aug.-Sept. 1963), p. 205. – Ed.]*

Delosperma cooperi
Photo: Robert Heapes

It requires considerable armchair planning to work out color combinations and to insure a garden full of color from spring until fall. A plan, drawn to fit your site and location, is necessary. This plan can also serve as a record of what has been planted, time of bloom, color and height. Your garden will never become monotonous if you plan carefully and select the right plants.

FIGURE I: This planting shows a color harmony of lavender and pink and ranges from deep purple and rose to lighter and more delicate shades. All of these plants were selected to harmonize in color and to bloom at the same time. The early blooming plants are followed by others whose colors correspond with the original scheme.

The border of this planting is a lavender creeping phlox which is planted 12 inches apart. Working the soil around these plants keeps out slugs which seem to like dense, undisturbed borders. To me, this way is more attractive for each clump stands out like a little bouquet. In my opinion, phlox should be planted in every perennial garden. Their beautiful shades of pink and lavender blend in wonderfully and make a good showing for a long time.

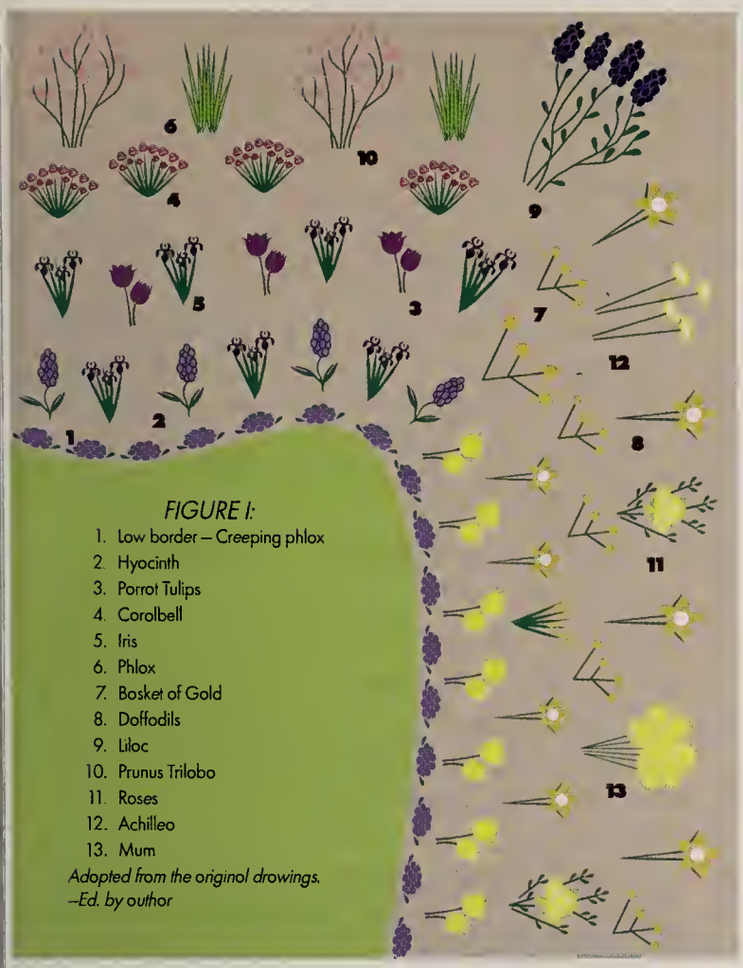

FIGURE I:

1. Low border – Creeping phlox
2. Hyocinth
3. Porrot Tulips
4. Corolbell
5. Iris
6. Phlox
7. Bosket of Gold
8. Doffodils
9. Liloc
10. Prunus Trilobo
11. Roses
12. Achilleo
13. Mum

Adopted from the originol drowings. –Ed. by outhor

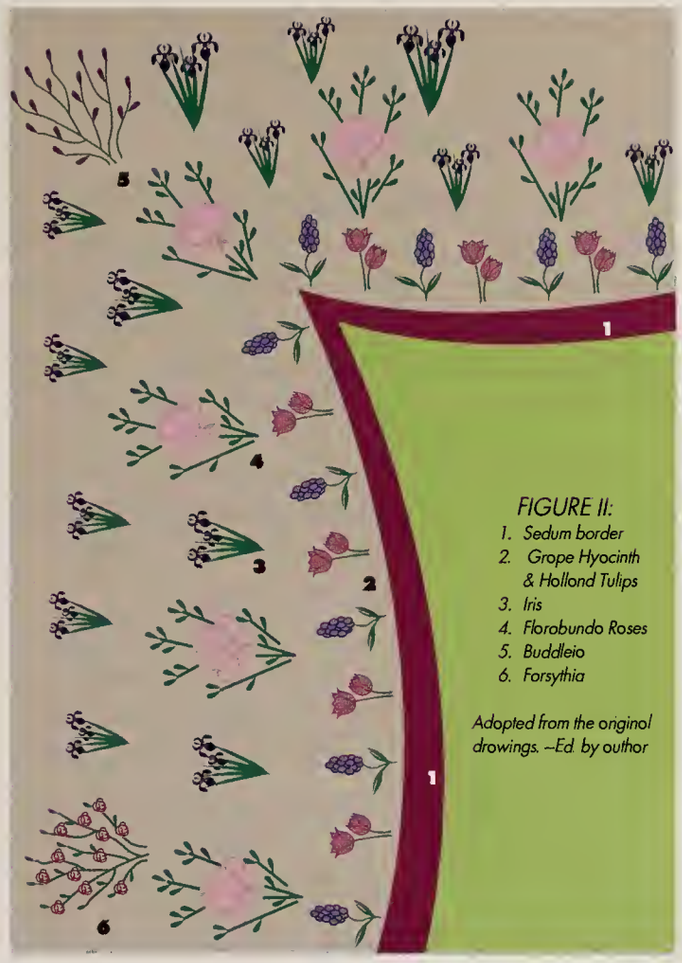

FIGURE II:

1. *Sedum border*
2. *Grape Hyocinth & Hollond Tulips*
3. *Iris*
4. *Florobundo Roses*
5. *Buddleio*
6. *Forsythia*

Adopted from the originol drowings. –Ed. by outhor

Next to the phlox are grape hyacinths, in alternating colors of lavender and pink. Right behind these are the parrot tulips, Violet Queen and Fantasy. Both the grape hyacinths and parrot tulips are replaced, following their bloom, by an annual of some kind. A semidouble petunia is a good selection as they will continue to bloom until frost.

Along the east side of this planting, the color scheme changes to gold except for the low border of phlox. It consists of daffodils, basket-of-gold, euphorbia, buttercups and a full row of Texas Gold (a parrot tulip). Later, they are followed by yellow iris, floribunda roses, achillea and yellow chrysanthemums. It is truly a delightful spot!

FIGURE II: Here I have a low, continuous border of a small, pink blossomed sedum which I have had for more than 15 years. It must be reset every two years or it becomes too matted. Slugs do not seem to like this particular variety for I have had little trouble.

Behind the sedum I have a spaced row of grape hyacinths. Next, a row of Holland tulips, which are planted in groups whose colors correspond. Each group is of the same color and was selected so it is complementary to its location. The same idea is followed throughout the summer by the use of floribunda roses, carefully planted as to height and color.

Most of my iris are planted in this section of the garden, intermixed with red Japanese poppies that bloom at the same time. They make the most striking and colorful display of the entire season.

Scattered throughout the rest of this section are plants of all kinds and colors that bloom at different times, such as oriental poppies, lupine, Shasta daisies, chrysanthemums and others. In each corner there is a tall, purple buddleia. In front of these buddleias I have planted a pink floribunda rose. Both bloom from early summer until frost and correspond with my complementary color scheme.

The following represents a partial list of annuals and perennials that I have found excel as border plants. From this list, one can select those plants that will blend in with any background.

Perennial Border Plants

All of the sedums make excellent low borders. A new variety is Indian Chief. In the early

fall, this lovely plant produces flower clusters of an unusual coppery shade and has attractive gray-green foliage. They are upright plants about 12 inches in height.

Alyssum or hardy candytuft makes a delightful companion for the early flowering bulbs and the iris. All the varieties, including Gold Dust (a golden yellow), make attractive low borders that bloom profusely over a long period of time.

Anemone is a charming perennial flowering plant and very suitable for use in borders. The Japanese anemone, which is 15 inches high, is my favorite. Anemones grow wild in many countries. The pasque flower anemone, a native of Great Britain, is one of the loveliest. It has finely cut leaves, grows 10 inches high and bears large, purple flowers in March.

We do not want to overlook the beauty and possibilities of a lily garden. The stately regal and madonna lilies, in glistening white, make an interesting section with other colors. White splashes, such as this, are needed in our gardens, but, an entire white section or border is not appealing to most gardeners. Among lilies, one can find different varieties that will bloom from June well into September. Hardly any other plant adds more interest and beauty to a landscape effect than a full border of lilies.

If you like warm colors, all the shades of yellow through orange and red, then day lilies are for you. Their rich colors fairly glow in the garden for a long time. They are disease resistant and grow in almost any soil and exposure.

The blue anchusa when interplanted with the old, lemon day lily, makes a very lovely planting. It is also beautiful with pink or crimson peonies. The new anchusa, Loddin Royalist, a vibrant purple-blue, makes a beautiful background.

Day lily and lupine combinations cannot be overlooked. The lupine produces flower spikes of outstanding form and color. Masses of these beautiful flowers, on heavy stems and in a variety of colors, are most attractive.

Lythrum, with its deep pink florets on dozens of spikes, works in well with most borders and has a long blooming season.

One of the loveliest of all the blue perennials is delphinium. The blue belladonna has an exceptionally rich, blue color and graceful habit. It is gorgeous with white lilies and is highly recommended.

The many colored, full-flowered spikes of the giant hybrid delphinium make it stand out in an early summer border. From soft blue and heliotrope to deeper shades, it makes a striking display with pink roses or other rosy plants. Gold Plate achillea is a good companion with the deeper blue varieties.

Delphiniums or other tall plants of exceptional beauty can be used as accent plants. Repeating them several times, at intervals, in a long border is preferable to planting them in a solid row.

[Omitted here is a list of annuals the author suggested for a summer border. Most of the varieties listed have been superceded by newer hybrids and are unavailable. – Ed.]

More Water-Smart Alternatives for a Continuous Border

*It's gratifying that most of the perennials suggested by the author over 30 years ago satisfy today's trend toward water-saving, or "water-smart" plants. Exceptions are the floribunda roses, madonna lilies (*Lilium candidum*), Japanese anemones (*Anemone japonica*) and delphiniums.*

Here are additional perennials that thrive with considerably less water than a bluegrass lawn – and contribute to a season-long parade of color.

- *Wine cup, or poppy mallow (*Callirhoe involucrata*): Dark wine, satiny blossoms nearly obscure a 2- to 3-foot prostrate mat of finely cut foliage from spring through fall.*
- *Purple coneflower (*Echinacea purpurea*): This tall pink daisy is a native of medium-dry meadows.*
- *Sulfur flower (*Eriogonum umbellatum*): This dryland native holds its heads of bright, light yellow flowers one foot above the low mounds of its grey-green foliage.*
- *Blue flax (*Linum perenne *ssp.* lewisii*): Astonishingly clear-blue blossoms on wirey, 2-foot stems open mainly in the morning and on cloudy days. They re-seed in undisturbed soil.*
- *Sedum 'Rosy Glow' or (*Sedum *x* hybridum*): This beautiful spreading succulent with early-summer blossoms sports attractive foliage the year around.*
- *Bonica™ rose or Pink Meidiland™ rose: These modern shrub roses are winter hardier and are not so thirsty as older floribundas, which often had a lot of semi-tropical "China tea" rose in their heritage.*

Color All Summer

by Kathleen Marriage

Kathleen Marriage taught classes in home landscaping and wrote extensively for magazines in this country and abroad. After studying horticulture and garden design at the University of London, she moved to Colorado in 1912. She opened a nursery, Upton Gardens, in Colorado Springs in 1916. Her experimental work with alpines brought under cultivation became internationally known. Among her designs were the Central City Opera House Garden and the planting plan for the garden at Horticulture House at 1355 Bannock, headquarters for Colorado Forestry and Horticultural Association. ["Color All Summer" by Kathleen Marriage originially appeared in The Green Thumb *magazine, Vol. 6, No. 5 (May 1949), p. 10. – Ed.]*

What is a herbaceous perennial? It is no disgrace not to know, but just in case some reader thinks so, a herbaceous perennial is a plant whose flower stems persist only long enough to allow development of seeds and whose roots may live for several years.

This living for years suggests stability and dependability, qualities which endear them to us and are responsible by their very permanence for pleasant associations. Those red peonies or this lily of the valley we are growing probably because we associate them with the joyous days of youth from which time has erased all unpleasantness.

Perennials are at their best in a big bold planting with a dense, high background of trees or shrubs or both, seen across a wide expanse of greensward. All this green depth permits us to take liberties with color that might produce tragic results in conflict with a bare wall, a bare driveway or patches of sunlight on bare earth. The first requirement is a green backdrop. For quantity and continuity of bloom our border must face the sun for at least half the day, longer in midsummer.

It seems scarcely necessary to warn real gardeners, or anyone with cultivated taste, against planting a bed of perennials or of any flowers as an island in an open expanse of lawn. Fortunately, these mid-Victorian geometrical atrocities are as passé as a Model T Ford.

Preparation of soil? Choice of material? Perhaps we may discuss here one perennial bed we made which is rather pleasant to look at and requires minimum maintenance. The bed faces south, is 45 feet long, about 8 feet wide, has a background of dense shrubs and evergreens which also form a screen from rear alley, and a 50-foot width of lawn between living room windows and front of bed. Top soil was rather poor on a gravel subsoil. Drainage was good but nutrients and humus were inadequate. We "double dug" the bed about 15 inches deep putting a 4-inch layer of manure in the bottom and incorporating a 3-inch layer of rotted dairy manure, compost and peat moss in the surface, tamping and moistening each three inches of fill. Sufficient amount of the bottom soil was removed to allow for the new additions.

Choice of plants? We wanted bold masses for good display —"gobs of vulgar flowers" — and gentler yellows and pinks for cutting. For a central bang we have Tulip Grenadier, 150 of them, in front of a group of Juniper monosperma. Then softening in color outwards are pink Darwin's Prusus and Clara Butt, eastward; yellows — Mrs. Moon, Inglescombe Yellow and Ellen Willmott — a must for its fragrance — westward all in self drifts of 50 to 75 of each. At the outer ends are groups of Carrara and Foam, our favorite for cutting. Behind and between yellow tulips are groups of Trollius europaeus; near pinks are drifts of blue Mertensia virginica. These combinations make a really gay show in late May. Following tulip season a central interest is maintained, still red, by a group of four

Peony Mary Brand. At four-foot intervals outwards are Peonies Therese and Walter Faxon chosen for their warm non-fading pink, and near the outer ends Peonies Nellie and Marie Jaquin, so arrangeable as cut flowers.

Following Peony season the central attraction is a group of a dozen or so Delphiniums, Millicent Blackmore in the middle softening outwards to mid-blue Pacific hybrids—still farther out a few Belladonna for cutting. Groups of irises at regular intervals give repetition both of distinctive flower and foliage which fill the gap between tulip time and peonies: Red Amber and the Red Douglas towards the center, next Ola Kola and Prairie Sunset, and near the ends Elmohr and Blue Shimmer.

Before the last peony has gone a few groups of Madonna Lilies followed by Regals give a cool, dignified air until phloxes are ready to begin. I'm sorry for the people who don't like these summer phloxes. They have not the airy grace of columbines nor the dignity of lilies but they have persistence in keeping on the job. If seeds are prevented forming, not — mind you — cut off when they have half matured, the late summer lateral flowers are even more enjoyable than the big first heads.

Of course, it is important to select good clear colors. After our Mary Brand Peonies we have Phlox Africa, fifteen of them in the center and following the same tailing-off pattern as with tulips and peonies are pink Phloxes Thor westward and Jules Sandeau eastward, finishing up with that best of all whites, Snowcap, originated by the late Darwin Andrews.

Since phloxes incline to be solid looking we have groups of Shasta Daisies, Sidalcea rosea and Clematis recta grandiflora between and near them to loosen them.

In the telling we've left out the part of the bed which we planted first, the back. Going out eastward from our central spires of delphinium are Aster Beechwood Challenger, Artemisia lactiflora and for a solid build-up at the end a good big wad of Aster Harrington's Pink. Westward are Helenium moerheimi, Salvia pitcheri, Aster Mt. Everest with last at the end a fat bulge of Aster Violetta.

Towards the front are two groups of Scutellaria coelestina to bring their blue spikes to the August sag. This sag can now be filled with azalea-mums, but since these are so insistent on hiding every leaf with their blowzy blooms I prefer their room to their company. Polyantha roses, World's Fair and Else Poulsen keep up the tune through August and September until the self-respecting real chrysanthemums bloom.

These are chiefly bronzes and reddish browns: Santa Claus, Mars, Indian Summer and Firelight with the yellows. Algonquin and Golden Lace to light them. Yes, I know what's coming. "Isn't the bed terribly crowded?" It is, but do you remember the food we put into this soil? Their pantry is well stocked. Then in planting for continuity as well as for mass we selected things that complement each other in bulk, and in time, for instance when Mertensia virginica disappears completely phloxes are cheek by jowl with her ready to fill the space. Near trollius also are phloxes, sidalcea and so on. Perennials are planted spang on top of tulips and these tulips are not dug up every year. It is surprising how many years tulips go on producing good flowers when there's good rich soil to feed the new baby bulbs each year. By the time tulip leaves are becoming unbeautiful new tops of perennials are coming up to hide them.

Since this bed is a unity, a self border strung along its front is not necessary, so we have a series of low growing things here that give continuity and color. Earliest are Alyssum saxatile citrinum, Arabis alpina, followed soon by Iberis Little Gem and a few lakes of Phlox subulata lilacina. Nearby is a group of Phlox divaricata beside a patch of dwarf Dianthus casius and Veronica amethystina. Between and immediately behind these front groups we like to have Petunia Cheerful or Salmon Queen. These are more friendly towards the warm pinks of our phloxes and Polyantha Roses than are the rosy shades.

For the first season, and later in gaps occasioned by recent division or mortality we filled up the gap in space and the August sag with annuals: pink and blue larkspur, Zinnia Old Rose and Enchantress and with biennials Suttons Campanula calycanthenia, pink, lavender as well as a few of the glowing purples for carrying effect.

The late summer sag is not quite so hollow if we keep our polyantha roses groomed and fed. Also dividing of Shasta Daisies both late and early instead of all at one time lengthens their blooming season well through August, and our stand-by phloxes go on till frost.

One temptation hard to resist is the urge to include a long list of varieties that we have seen and made notes to buy and plant. A legitimate ambition, but we really must refrain from cluttering up this design with them. So we planted them in a trial bed in the cutting garden. In this bed which we see every time we look out from our living room we wanted to avoid a spotty appearance so in no case did we plant less than five plants of a kind (except peony varieties) and for the larger key masses ten to fifteen.

For repetition, so necessary to good design whether of a fugue or a flower garden, we used Monarda Cambridge Scarlet confessedly with trepidation for its form has no dignity but its warm color and tirelessness in flowering make it desirable. In a more intimate bed seen at close quarters we might not have dared this.

Now all this bed needs is weeding, cultivating and frequent grooming. Cultivating is easy since we keep a mulch of peat moss on the surface. There is little room for weeds. Grooming frequently: cutting off fading—not faded—flower stems, staking before its need becomes apparent does much for the attractive appearance of the garden.

Such a perennial garden is easily maintained, but no garden will maintain itself without making some demands on its owner. Now with all this boasting, the bed at this moment needs weeding and edging. There are chrysanthemums to be divided. Asters to be thinned, self-sown Canterbury Bells and Sidalcea for which to find a kind home. Better I stop this futile scribbling and get to work.

Peat moss? Not from the Rockies!

We've come a long way in nearly fifty years. In 1949 Front Range gardeners were grateful for any amendment to improve their poor soils, any organic mulch to keep down weeds.

However, with a growing awareness of the complex relationships within and among ecosystems has come an awareness of the shortsightedness of mining peat bogs, sphagnum or other kinds. Although peat is composed of once-living plants, it can hardly be considered a renewable resource. Growth from thousands of years form but a shallow layer of peat. And, once mined, the site may never renew itself. None have.

The wrongheadedness of mining peat is especially acute in the high mountains, including the Colorado Rockies, where peat fens serve important roles of water run-off regulation and filtration. Regulating the flow of water, they not only reduce downstream erosion but contribute to underground water supplies.

More telling from a gardener's standpoint, mountain peat (commonly sold also as a component of potting soil and "top soil") is high in calcium, high in pH, highly variable in chemical composition and astonishingly low in organic matter — often containing less than one-quarter the organic matter of sphagnum ("Canadian") peats. It is just what Colorado gardens do not need.

Alternatives? Composted and ground yard waste, wood chips and other wood waste (including expired Christmas trees), and manures.

Plants for the Back of the Perennial Border

by Mrs. Harracena Newman

Harracena Newman had a large cutting garden near Regis Callege. She and her husband Jahn experimented with new and unusual plants and grew many reliably hardy anes as well. A member of the board af directars af Calarada Farestry and Harticulture Association, after the arganizatian merged with Denver Batanical Garden she served aften as a ane-person "Dr. Green" at Botanic Gardens Hause. ["Plants far the Back af the Perennial Border" by Mrs. Harracena Newman originially appeared in The Green Thumb *magazine, Val. 8, Na. 8 (Aug. 1951), p. 14. – Ed.]*

Penstemon grandiflorus
Photo: Robert Heapes

These plants which I am suggesting are nice for the tall background of your perennial border. Of course, these are only suggestions and not all should be used, nor are these all that can be used. Remember always to plant in groups for mass color effects and to prevent "spottiness."

For Spring the climbing roses and silver lace vine are nice, if you have a high fence, trellis or lattice work support. Try a grape vine also. When not in bloom the foliage of these are very attractive.

For a tall spike formation you might use delphinium. The range of color is rather wide; from dark blue to the very light blues, white, art shades to almost red. These may require a little more care than some plants; but repay in beauty. They may have to be staked if not protected from the wind. If the first bloom is cut to the ground, they will give a second bloom later in the fall but not as tall as the first growth. Foxglove or digitalis, which is a biennial, is very beautiful, about four feet high. Monkshood or aconitum comes in several shades of blue and blooms in July and August, as does Tritoma, or red hot poker as you may know it, which also combines nicely with the day lilies or hemerocallis.

For lacy mass effects the white daisy-like boltonia blooms late in August, as does the spirea, white astilbe, Japonica or pink astilbe, Davidii. These latter have plume-like flowers. These die back in the fall and make new growth each year. Their height is about five feet. Rich moist soil is best for these. For lovely foliage as well as for plume-like bloom, try meadow rue or thalictrum. It comes in light yellow or purple colors. Another is lythrum, which is almost a "must" in every garden for its lovely spire of gay flowers. The tall white ageratum, Valeriana, is

Photo: Charles Mann

another in this group. Transplant the increase either in the fall or spring. I would recommend spring for this locality.

Don't overlook the tall lilies—white regal and the centrifolium, which is a hybrid of the regal. Also, yellow Henrii, or the orange red tiger lily. All lilies are best planted in groups of three, five or more.

If you have room for the coarse foliage plants, such as the intense blue Chinese forget-me-not, anchusa, helianthus (one of the highly developed sunflowers) with their color range from yellow to almost red, the yellow yarrow, achillea and the steel blue globe thistle, echinops. All of these are excellent cut flowers and for drying for winter bouquets, the lovely steel blue and yellow combination together with the cone of the cone-flower, rudbeckia, are unexcelled.

For late fall bloom, the tall fall asters, Michaelmas daisy, and the tall chrysanthemums will give you a riot of color until snow. If you have a spot you wish to hide, either in your own or your neighbor's garden, plant some of the new hollyhocks. Althea is a beauty, and goldenrod or golden glow. Don't be afraid of hay fever, for they are not the guilty parties; the pollen from the rag weed can settle on any flower.

From your catalogs and garden books, select the colors and plants for the background that fit into the plan you have made. They should complement your home inside and out, and you.

Behind a Water-Smart Border

Finding tall perennials for the back of a low-water border may present a challenge. However, with the help of ornamental grasses, shrubs and small trees, you can create a beautiful and functional background.

Tall perennials – more than 3 feet

- *Foxtail lilies (*Eremurus *hybrids): Imposing spires of tiny blossoms in pastel shades from white to coral make these most desirable plants. Once established, these members of the lily family are quite durable and will even re-seed.*
- *Mullein (*Verbascum bombyciferum*):*
- *Palmer's beardstongue (*Penstemon palmeri*): This plant lends grace with thin stems of intensely pink tubular flowers*
- *Maximilian's sunflower (*Helianthus maximilianii*): These bright yellow sunflowers have the unusual habit of producing many flowers along its tall stems.*

Tall perennials – 2 to 3 feet

- *Baby's breath (*Gypsophila paniculata*): This is the common baby's breath. Its airy blossoms come in either white or pink.*
- *Snowdrop daisy (*Tanacetum niveum*): Small, abundant daisy-like flowers.*
- *Husker beardstongue (*Penstemon *'Husker Red'): Although its pale flowers are beautiful, grow this one for its beautiful maroon foliage.*
- *Jupiter's beard (*Centranthus ruber *'coccineus': This vigorous grower puts forth red flowers all season.*

Some grasses to place toward the back of the border where their late-summer-through-winter seed heads will catch attention are Calamagrostis, Sorghastrum nutans *and* Miscanthus sinensis.

Attractive shrubs are Artimisia tridentata *(silvery-grey foliage), butterfly bush and sumac (brillant fall foliage).*

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Planning a Space Garden or a Garden Space? Plant Perennials!

by Bernice Lucas Petersen

Bernice "Pete" Petersen, former editor of The Green Thumb, and her husband "Big Pete" tend a large garden in Littleton. Filled with unusual species, it is witness to their love of plants, especially of those of Colorado. Both were instrumental in organizing early DBG plant sales and in championing a Rocky Mountain horticulture. ["Planning a Space Garden, or a Garden Space? Plant Perennials!" by "Pete" Petersen originially appeared in The Green Thumb *magazine, Vol. 21, No. 1 (Jan.-Feb. 1964), p. 7. – Ed.]*

In this age of satellites and spaceships the contemporary gardener might cultivate only sweet rockets, moonflowers, sunflowers and shooting stars. Whether your space garden encompasses two city lots or a small acreage, a well-planned perennial border orbiting on your garden axis is a must.

Assuming earth-bound gardeners will remain active for a few more enjoyable years, suggestions for planning a perennial border in your garden space are appropriate. "A few enjoyable years" is the phrase that cinches the planting of perennials. Some, such as peony, gas plant, lupine and Christmas rose are cherished for their endurance and resent being disturbed at all. Most perennials, however, should be divided every three years and aggressive varieties of chrysanthemums, hardy asters, day lilies and iris require even annual division.

When choosing plants for a given location, remember a sunny border requires a different series of plants than a shady one. Consider whether your background is a brick wall, sapling fence or the ideal dense planting of trees, shrubs or evergreens. Consider, too, the foreground. Is it a plush expanse of greensward or a bare driveway? Duration and intensity of sunlight have a definite bearing on plant suitability, amount of bloom and degree of color trueness.

Illustration: Polly Steele

After you have defined your perennial border location and shape draw the border to scale on paper; two feet to the inch is satisfactory. In this planning stage most flower-happy individuals anticipate how many kinds of plants they can accommodate instead of how few. Restraint is the key. Big, bold masses of a few flowers add zest to any border. Unless the plant spreads quickly avoid planting less than three of a kind, prefer-

Dividing Time

Many well-behaved perennials do not need to be divided every three years. The best rule of thumb for dividing perennials is – whenever they need it: they've outgrown their space, died out in the center or have lost the energy to bloom. Take the opportunity then to renew the fertility and organic matter in the soil: dig in plenty of compost.

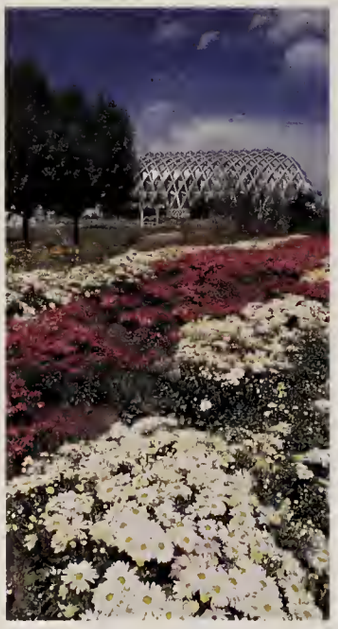


Photo: Robert Heapes

ably five. Bulbs should be planted 12 to 25 of a variety in a colony. However, small gardens or nooks must be scaled to use a single large-growing plant for accent.

Like cosmonauts certain plants are more compatible. their flowers or foliage complement each other in color, form and texture. While color and height are significant, equally important are texture and shape to prolong interest after flowering. Picture the space partnership of Madonna lilies and clear blue delphiniums accented with 'Elsi Poulsen' floribunda roses, the early blooming clematis 'President' with the fine white peony 'Le Cygne' or Colorado male fern with Rocky Mountain columbine and 'Perry's' blue Siberian iris. Are you in orbit?

If your border has at least four hours' sunlight extend the blooming season over the longest period with delphinium, iris, peony, hardy phlox, day lily, hardy aster and chrysanthemum as key plants. These perennials lend character and accent, so select choice varieties. Study catalogs carefully. With the adoption of a standardized color wheel by plantsmen throughout the nation, catalog descriptions have attained greater uniformity colorwise. If you're color cautious you will want to grow an untried plant in a test area. If space is limited but your visions unlimited, try it now!

Unless your scheme involves merely one or two colors, the only limitations are avoiding strange contrasts such as scarlet-red with blue-purple. Many authorities use white as a peacemaker between colors to subdue them. Others insist white is an intensifier to be used as a separator or to arrest attention. The interpretation is yours. At any rate, greys and low-valued greens tend to harmonize hues and whites are pleasing both in the evening garden and cool, shaded garden.

Even in space gardens, plantings are not fashionable in circles, crescents or stars. "Drifting and Dreaming" is the theme. Let the dainty Virginia bluebells drift into bays of garden pinks and bleeding hearts; let 'Africa' phlox drift into groups of Shasta daisies. Are you dreaming? Then let's head back to the border. Drifts should be rather long and narrow with tall perennials flowing into the medium and even lower-growing bays to hid fading blossoms and foliage. With the disappearance of chiming bells or leopard bane in the spring let annual petunias take over. Balloon flowers, Shasta daisies or tall snapdragons will cover faded poppy foliage. Repetition of drifts or large single specimens at regular intervals lends accent, unity and strength to a good border.

If you like, start planning at the back of the border. Include flowering shrubs for tall bloom in spring followed by delphinium, tall meadow rue, false indigo and hardy aster. Peonies, phlox, lilies, some day lilies and floribunda roses are among the many medium-height plants for the middle portion.

Put the edge on the border with plants of good enduring foliage. Coral bell, low veronica, perennial candytuft, hardy pink, blue fescue, all fulfill this requirement. If you prefer continued color, supplement perennials with such annuals as alyssum, dwarf marigold, ageratum or verbena.

Are you ready for the test trial? Some warm winter day hie yourself to the planting area using markers to indicate each plant name and variety in its proper space. Not only can you visualize the appropriateness of your plan, but with these stakes you will facilitate the actual planting on countdown day in mid-April.

3 - 2 - 1 - zero!

May 15: "Blast-off almost perfect?"

"Roger, the plants are growing.
The garden's under way."

Border Back-ups: Water-Smart Shrubs

Shade: Viburnum *x* rhytidophylloides *'Allegheny'*, Mahonia aquifolium, Pieris japonica, Amelanchier alnifolia

Sun: Cercocarpus ledifolius, Cowania, Quercus gambelii, Rhus glabra, Amorpha canescens, *rabbitbrush, fernbush*

The August Gap

by Julia Jane Silverstein

Julia Jane Silverstein is now Jane Silverstein Ries, whose career as a landscape architect is the longest in Denver's history. A graduate of the Lawthorn School of Landscape Architecture for Women in Groton, Mass., she specialized in intimate gardens, designing many in the Denver Country Club neighborhood. She designed the Herb Garden extension, the Scripture Garden and the Laura Porter Smith Plains Garden at DBG. The Jane Silverstein Ries award of the American Society of Landscape Architects is presented annually to a person who makes an outstanding contribution to stewardship of the land. ["The August Gap" by Jane Silverstein Ries originially appeared in The Green Thumb *magazine, Vol. 6, No. 8 (Aug. 1949), p. 14. – Ed.]*

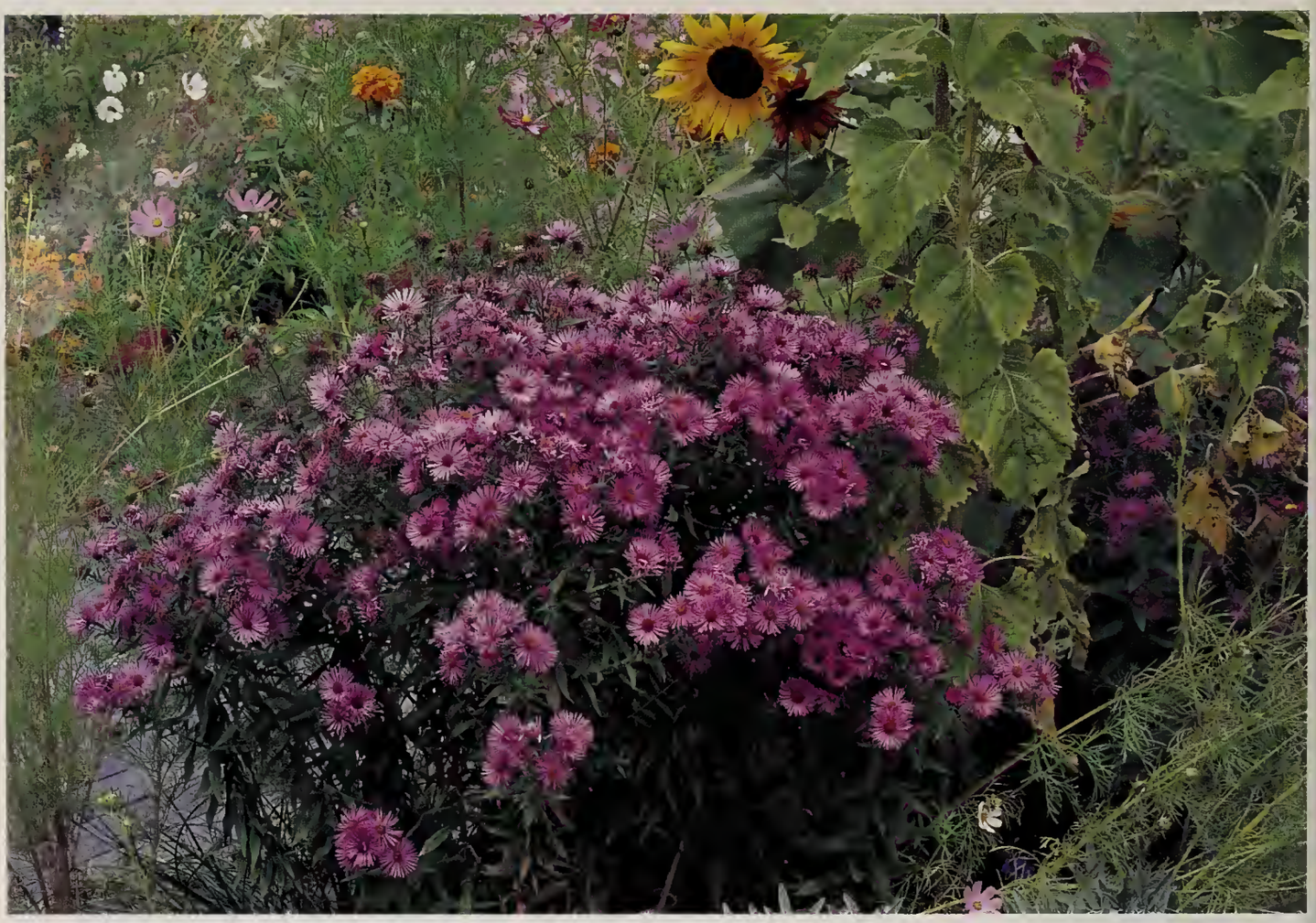
We hear much of the "July Slump" and the "August Gap" when gardeners speak of the lack of bloom in the flower border. Since you have suffered through the "July Slump" let us look forward to the other sad state of affairs, if it can be called that. I am in hopes that by the time you have waded through the following, you will be able to feel that August is a mighty fine month in the garden after all.

The reason we are so especially disappointed with the color in the July and August garden is that we have been so surfeited with the glorious display that June has presented to us that we expect this magnificent show to continue. To me it is most gratifying to have some quieting down of gay colors into cool greens, especially as the days become warmer.

Contrast of foliage textures can be as stimulating and pleasing as flashy colors. Notice a groups of Columbine leaves in front of Iris spikes, in back of which is the soft gray foliage of the Sulfur Meadow Rue (Thalictrum glaucum); in the more shaded areas the large heavy leaves of Plantain Lilies (Funkia) among Fern fronds with an occasional Day Lily (Hemerocallis) arching in the background. The tower-like foliage of Regal, umbellatum or Tiger Lilies makes lovely accents strutting out of Phlox, Columbine or shiny Peony clumps. Along the front of the border for edging, the gray tuftiness of Dianthus (Clove Pinks) with the gray grass of Festuca glaucum with the circular Coral Bell foliage (Heuchera sanguinea), also Sedum spectabile in front of German Iris—all give interest, and not a blossom in the bunch.

Photo: Charles Mann

But don't be discouraged, there is a great deal of color to be had, Phlox in great variety gives some of it to us, with Globe Thistle (Echinops ritro) and early Monkshood (Aconitum sparksi). Since Phlox is the iron clad perennial for this season, care should be taken in selecting varieties so as to avoid an overabundance of mediocre ones, instead of the



Aster sp.
Photo: Charles Mann

three or four that exactly fit. Try to restrict yourself to varieties that belong to a single color range rather than a mixture of all colors, and use a touch of white sparingly. One can choose the pale pinks through the true pinks to richer salmon and a few of the polka dot varieties, the white with pink or red eyes. Or you may want lavender shades with a few magenta tones and even an occasional deep red. A cool effect for the hot August days can be obtained with mostly white Phlox with a few soft lavenders like "Silverton" and the metallic flowers of Globe Thistle and Sea Holly (Eryngium amethystenum).

The annuals, of course, lend the most vivid colors to the garden at this season—they should be selected carefully so that they will fill in and blend with the perennials. Zinnias, Snapdragons, Dwarf and even Giant Dahlias, Chinese Asters, cleome, Nicotiana, Petunias, Lobelia, Torenia, and Sweet Alyssum can be combined with some perennials if carefully thought out. I always like to tuck in a few Nicotiana (Tobacco Plant) for the wonderful fragrance it brings to the garden in late afternoon and night. It comes in shades of deepest red through to white.

The early chrysanthemums such as Aladdin and the profuse blooming azalea mums with the dwarf Asters give bloom for the edge of the border. Some of the late blooming Day Lilies especially the pale yellow ones are stunning with light pink Phlox and Salmon Phlox with a mass of Giant Lemon Marigolds.

One of the characteristics of the August border which is apt to make us think it less attractive than other seasons is its untidiness caused by the June flowering plants gone by and a few straggly blossoms left on the July ones. We need to prune back some of the too rank top growth of these early plants to keep order in the border. Avoid cutting the plants back too severely, since some foliage is needed to give energy for next year's bloom.

So many people think they must have a mass of bloom all summer long, but there isn't space enough in the average garden to provide such a color display even if it were desirable. For one cannot fill the same space with all spring plants and cover that space with the June, July, August, and September plantings. The only way to have such a display would be to have separate borders for each season, if your grounds could

provide such a setting. This would be impractical in most average gardens. Another question asked so often of a plant—"Does it bloom all summer?" The answer to this is usually "No"—and I would like to add, "How dull if it did." How would you like to have the Peonies and Iris till September or Tulips till August? I'm sure we would be sick of them, and lose the thrill of Spring. It is fun to look forward to the buds of each new season, and to even let the roses have a rest, it gives us a glad expectancy to have them come again later in the season.

Gardening is a stimulating hobby and it is a good thing for us that each plant knows better than we do when its time for blooming comes along. What a mess we'd make of it if we had everything blooming at once. I for one am glad not to have to see the same old blossoms on the same old plants all year long.

Again let me emphasize that foliage background for any flower is essential to and should be retained as a foil and adjunct to all color pictures. In our border I retain an Iris, of the ochroleuca variety, which has never blossomed. It has stately lance-like foliage about three feet high which is essential as an accent in my picture. The Meadow Rues are another favorite of mine along with the shiny leathery foliage of the tall late Monkshood with some Siberian Iris as a background for blooms. Let us not overlook the grasses which can be very stimulating at this season. The waterfall effect of the 6'-8' Eulalia japonica zebrina cascading from a background planting, and the more compact Fountain Grass (Pennisetum japonica) growing 24" to 30" high can be used effectively.

Fruits of many of the shrubs are now getting color; Honeysuckles, Viburnums, Cotoneasters, Crabapples all can be used in the background of flower borders.

We still have a few more plants for color in August other than Phlox: Heleniums, Buddleias (Butterfly Bush), Boltonia (tall white Daisy), Chrysanthemum uliginosum (tall Daisy), some of the early Asters (Michaelmas Daisy), and Artemisia lactiflora (Southernwood)—with fluffy sweet scented flowers growing about 5' tall.

So, you see, there is really no dearth of bloom if combinations and timing all work out. Weather, soil, exposure, humidity—all make some differences in blooming dates causing a variation from season to season and year to year. We can't very well force nature to our will; we can only hope that our planning will sometimes work according to schedule.

Don't forget that any border or seasonal picture that does not rely on more foliage than bloom is bound to be garish. A picture which is a blur of color can never be truly effective.

Choice Modern Phloxes (P. paniculata)

Mount Fuji	*tall white*
Pinafore Pink	*16-inch bright pink*
Bright Eyes	*pink with bright red center*
Orange Perfection	*orange*
Star Fire	*cherry red*

Daylilies to Fill the August Gap

Beauty to Behold	*yellow*
Autumn Minaret	*orange-yellow*
Autumn Daffodil	*pale yellow*
Atlas	*yellow*
Stella de Oro	*golden yellow*
White Temptation	*white*
Houdini	*rose-violet with cream eye*
Oriental Ruby	*carmine red*
Vera Biaglow	*rose-pink edged with silver*
Jan Mellon	*creamy melon*

Ground Covers for Many Conditions
(with some of their ornamental associations)

by Helen Fowler

Helen Fowler, for whom DBG's library is named, was a dedicated member of Colorado Forestry and Horticulture Association. She gave more than 500 volumes of to form its core collection and formed a committee to raise funds for its continued growth. As owner and operator of Shadow Valley Gardens in Wheat Ridge she planned and planted many gardens for wealthy patrons throughout Denver. She served as an expert – often at gardens she had designed – on CF&HA's "Look and Learn Garden Tours (precursor to the currently defunct Denver Botanic Gardens Guild garden tours). For almost two decades she contributed feature articles and fillers to The Green Thumb magazine. ["Graund Cavers far Many Conditions (with some af their arnamental ossociotions)" by Helen Fowler originially appeared in The Green Thumb *magazine, Val. 9, Na. 12 (Dec. 1952), p. 19. – Ed.]*

Years ago, we heard very little of ground covers. There is hardly a new garden built, today, where plans are not made for their use. In nearly every garden there are raw-earth places that are not pleasant to look upon. The lack of light under shady trees and the heavy drip following snows and rains kill the grass year after year. In other places, the top roots of trees take all the food intended for lawn grasses. There may be steep banks facing the noonday sun and banks in the shade that are constantly giving the gardener trouble and expense. In choosing covers for such places, we should be interested in their habit of growth, their density and attractiveness of leafage, so as to keep them good-looking for as long a period as possible. In this relation, their habit of growth, is perhaps on of the most important factors so we should pick out from the low-growing types only those varieties which make close mats or foliage or which have creeping or spreading growth. A ground cover is not wholly confined to trailers, creepers and vines for there are several classes of plants for covering ground beside the low-growers; such as, shrubs, semi-shrubs and perennials, including ferns of all kinds, columbines, funkias, saxifrages and many others of similar heights.

Back as far as 1927, even earlier, the list of plants for that time was brief. These plants proved satisfactory then, as they do today. The list included ajuga, with its clear blue flowers in early June. The kind then known was from Geneva, but a new kind with bronze foliage has since been introduced. Using both A .genevensis and A. brockbanki in one planting makes a smart effect. Myrtle also combines well with ajuga. This myrtle Vinca minor (there is a V. major also with larger leaves and larger, bluer flowers) is a well-known evergreen—evergreen only if protected from the winter sun—used for covering banks, terraces or planting in large beds under trees, as well as interplanting among shrubs.

We still have more of the older kinds of plants for selection—thymes and sedums; both may touch up the cracks between stones on terraces. Now the sedums—as I go from garden to garden I see only a few, and all the same ones in all the gardens—just a few varieties. Now there are dozens of both gray and green-leaved to choose from—S. aizoon, album, altissimum, dasyphyllum, douglasi, maximum, middendorfianum, murale, obtusatum and the more-used spurium in pink, white, dark and light red for both sun and shade. Many know the S. spectabile brilliant, valuable for so many situations and for its late bloom. It is in full flower today, October 8. S. ewersi, glaucum and seiboldi have soft gray foliage, with S. seiboldi being the aristocrat of the entire Sedum group.

For use in the shade, in perennial borders, English primrose with forget-me-nots are the sweetest of spring combinations. For shade or sun Euonymus kewensis is an evergreen bittersweet, of fine texture with nothing better for cov-

Sedum spathufolium
Photo: Charles Mann

ering around statues or birdbaths or small pools. It does not transplant easily except in pots on account of its single root system. It is not a large plant so should be selected for small places. Then, there are English and Baltica ivies, Hall's honeysuckle and the lovely but questionable pachysandra. Here, the pachysandra does not grow like it does in the East.

There is one ground cover, thought perhaps the loveliest of all, for use in the sun only, which is the dwarf silver lace vine (Polygonum reneutria). Its deep-red buds, seen early, with its light green foliage all summer and crimson foliage in the fall, makes the writer always think of this plant when the "B-r-e-a-t-h-t-a-k-i-n-g" ad comes over the radio.

Lily-of-the-valley is well known but few know how to care for it. After blooming it should be covered with well-rotted fertilizer and kept damp. What is done this year will govern its growth for next. Lysimachia, the old moneywort, never does well in the sun. It is ornamental for places around pools in moist soil. One of the loveliest for sunless spots is Asperula odorata and another, the snowdrop anemones, A. sylvestris, with its sometimes nodding pure white flowers. The anemones prefers not too dark shade.

If your low growing campanulas are not thriving in the shade, move them to the sun. Here you have over twenty kinds to choose from. Cypripedium, (the lady-slipper or moccasin flower), asarum, (the wild ginger), podophyllum, (the mayapple) trillium and many more are rather special in their requirements, preferring a rich, woods soil in the shade.

You will have many areas in the sun where you can plant the following: cerastium, dianthus, iberis, arabis, alyssum, the various sedums, phlox amoena and P. subulata, veronica repens, euphorbia epithymoides, geum triflorum, globularia. Coralbells, heuchera retains its good looks the entire summer. It is useful as an outline cover for perennial border margins.

Gardeners should plan to meet the ground covers, which are numbered by the score here in Colorado. You will be glad you know them when you run on to the many places in the garden where just nothing else will qualify.

Mulch – Another Ground Cover

Some places seem to reject living ground covers, no matter how often we try to plant them –underneath low-branched, old Colorado spruce or Engelmann fir trees, for example. It's also futile to plant ground cover plants in a renovation project where viciously invasive perennial weeds – bindweed, orchardgrass or thistle – have been a problem, unless a full growing season has been dedicated to eradicating the weeds. No living ground cover will smother such persistent interlopers.

In such areas an organic mulch is in order, preferably wood chips, such as those derived from grinding tree limbs – not expensive bagged bark chips, which take forever to decompose into matter beneficial to plants. A thick layer of organic mulch inhibits weeds without the need for an underlayer of black plastic.

A wood chip mulch also is beneficial under ground cover plants. Vinca and other spreaders readily multiply in it, and spring and summer bulbs emerge through it with no problem. Both bulbs and ground covers appreciate the moisture conserving qualities of a layer of such an organic mulch.

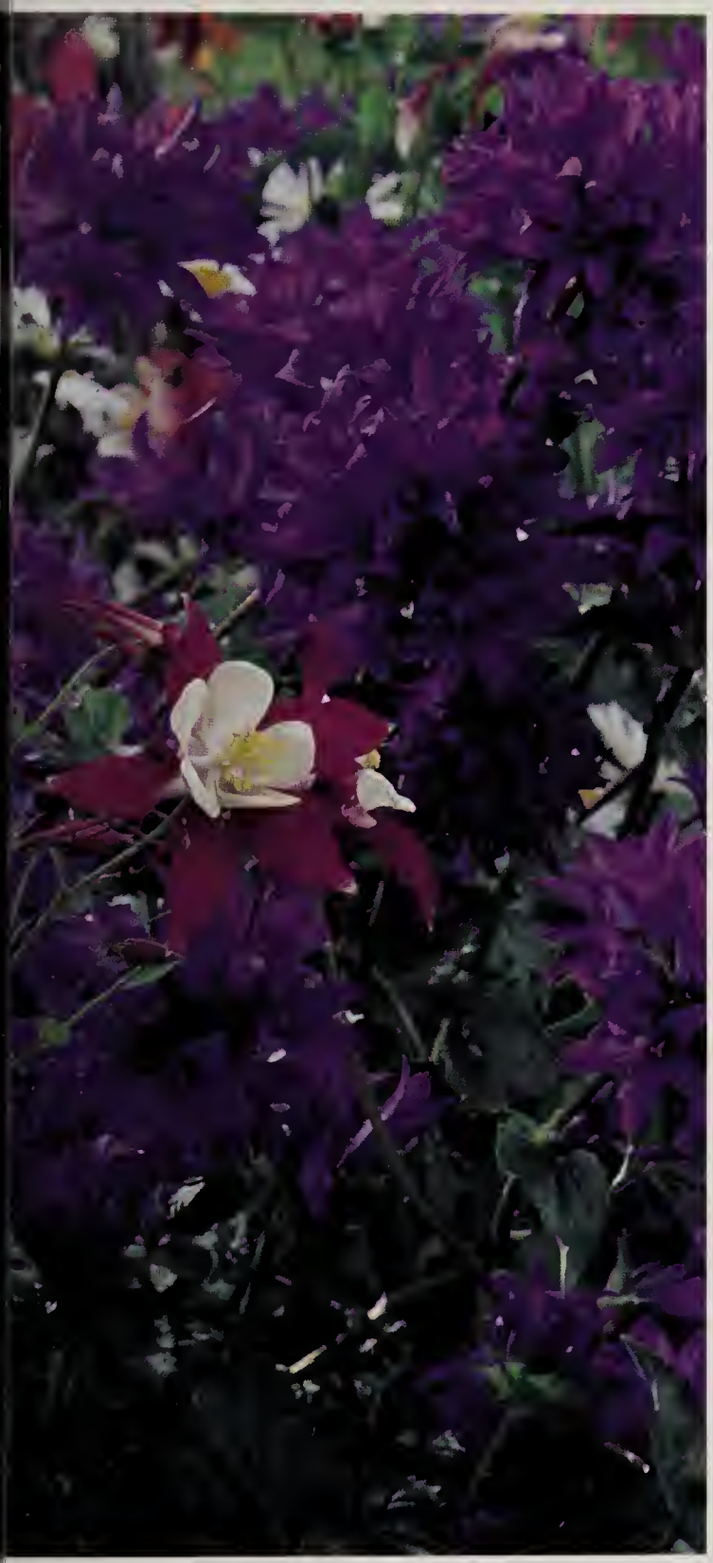
Plants for the Shady Garden

by Myrtle Ross Davis

Myrtle Ross Davis was a knowledgeable gardener and artistic flower arranger, popular as a speaker and writer for horticultural organizations. An active member of CF&HA, she graciously showed her garden on "Look and Learn Garden Tours" and served as an expert on other tours. ["Plants for the Shady Garden" by Myrtle Ross Davis originially appeared in The Green Thumb *magazine, Vol. 12, No. 4 (May 1955), p. 18. – Ed.]*

Aquilegea hybrids
Photo: Charles Mann

Trollius sp.
Photo: Charles Monn



So often I have heard people say "I can't grow any flowers in my yard because I have too much shade." Some of the very finest perennials do best in shade and there are others which will not tolerate direct sun at all.

Of course, it may not be shade which causes their trouble, but tree roots. No flowers will thrive if they have to compete for water and nourishment with the roots of fast growing trees.

When we think of shade plants we generally think of ferns. They must have shade and the native varieties do not require a great deal of moisture. Colorado male fern is probably the best fern to grow in our gardens, but it is becoming increasingly more difficult to obtain. The lady fern, also a native, is a more luxuriant grower and multiplies rapidly. The dainty rock fern we find growing in our mountains does very well in our gardens.

The most beautiful of all shade plants are the tuberous begonias. They are the most trouble to grow because they have to be started indoors in early spring and taken up before hard freezing weather in the fall. However, they are certainly worth the trouble because their blossoms are very beautiful and last over a long period. They bloom from July until frost.

Primroses, especially the polyanthus type, enjoy the dapples sun and shade of the shady border or nook. They will bloom for a month or six weeks in the spring and the same plants will sometimes have a few blossoms again in the fall. They multiply rapidly under favorable conditions and come in such a wide range of brilliant colors that they are a joy to grow.

Columbines will grow in the sun but they like shade better. They can be grown easily from seed and come in a wide range of colors. However, they are a short-lived perennials and hybridize so readily that the self-sown seed usually produce light yellow flowers. It is best to buy the selected shades and never allow them to seed in the garden. The native Colorado blue is the most beautiful, in my opinion. Sow fresh seed in August. Old seed will not germinate properly.

Meadow-Rue or Thalictrum has fine columbine-like foliage with small yellow or lavender flowers. It grows two or three feet tall and looks pretty growing among the tall ferns.

Dicentra spectabilis and Ajuga reptans
Photo: Charles Mann

Some of the newer varieties have good sized flowers and are quite nice.

Old-fashioned bleeding heart is one of my favorites. When my plants die out after four or five years, I always buy more young plants, because they are too attractive to do without.

Another old-time favorite which requires some shade is the Lily-of-the-Valley. They bloom best if given about an inch o f barn-yard fertilizer in the fall.

For the cool blue color we all enjoy so much in our gardens we can grow Mertensia Virginia or the Chiming Bell from Virginia which flowers in the spring and Aconitum, Monkshood, which flowers in late summer. I always try to have some fox-gloves (Digitalis) growing in my shady border. Their tall spires look well in the background.

Trollius or globe flower with its large butter-cup flowers of orange or gold is an excellent shade plant.

There is a little white Anemone alpina that I have had for years. It blooms in May. Anemone japonica is another excellent kind which blooms in the fall. September charm is a hardy beautiful pink flowered variety.

A tiny little pink Androsace carnea forms emerald-green mats studded with loose heads of pink flowers.

I must not forget to mention those excellent flowers from the eastern woods. May-apple, Trillium, Bloodroot, Dutchman's breeches and the Hellebores (Christmas rose and Lenten rose) all make good shade plants.

Some large-leaved plants which give the garden a variety in texture are the funkia lilies. They have white or purple blossoms and some have beautiful variegated leaves. Bergenia or Saxifraga cordifolia has large leaves and beautifully branched pink blossoms.

I have grown the native orchid, yellow lady slipper and another one from the eastern woods quite successfully in my garden. Two other real gems which I have had are ground Dogwood (Cornus canadensis) and Alpine Columbine (Aquilegia saximontanum). I try to keep the soil rich in peat and leaf-mold for these acid-loving plants.

These are the shade plants that I have grown successfully in my garden, but I am sure there are a great many others which would do well in Colorado gardens.

Tuberous Begonias? Really?

Unfortunately, as stunningly beautiful as they are, tuberous begonias in the Rocky Mountain region are best for stay-at-home gardeners and those willing to pamper their plants – endlessly.

They are best grown in containers or in raised beds of specially prepared, porous, moist, humusy soil. Grown apart from other garden plants, they can be fussed over more easily.

To combat powdery mildew – encouraged by dry, motionless air – wash their leaves frequently in hot dry weather with a coarse spray of water. Protect the fleshy, brittle stems from breaking in the wind by staking them. Or, if they're in pots, bring the plants indoors when it's windy.

Tuberous begonias grown on the High Plains seldom attain the floriferous splendor pictured in catalogs.

Ornamental Grasses

by Gayle Weinstein

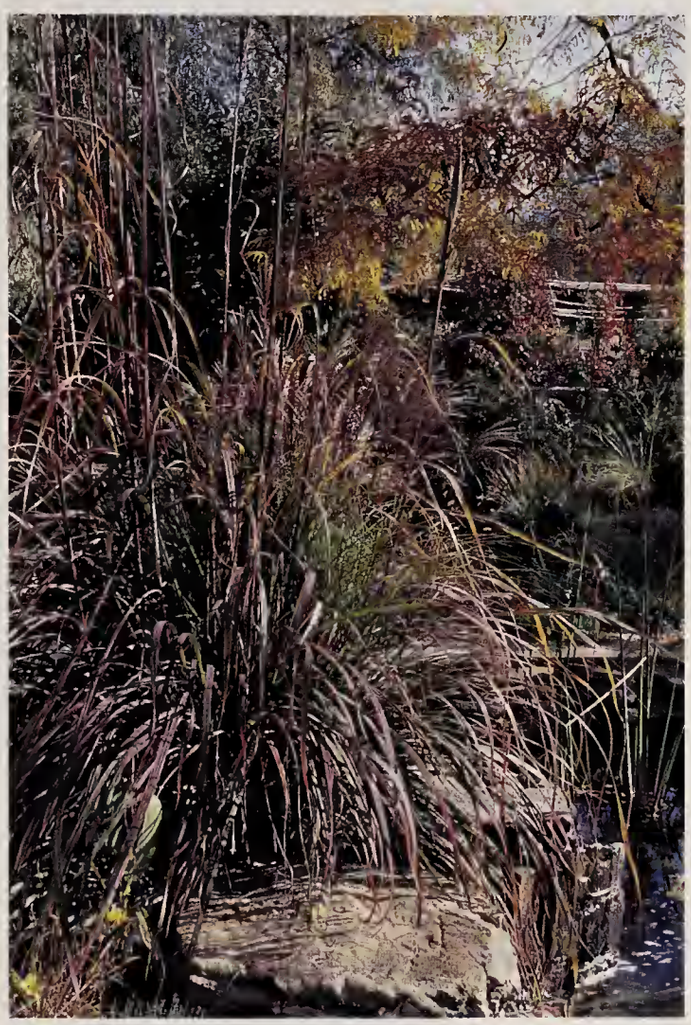
Gayle Weinstein was manager of plant collections at Denver Botanic Gardens, where she was instrumental in introducing many new plants to the region's horticulture. Her sensitive design is reflected the lovely garden around Botanic Gardens House, the WingSong Garden, the Laura Porter Smith Plains Garden and Xeriscape Demonstration Garden. She now is an independent landscape designer, teacher and consultant. ["Ornamental Grasses" by Gayle Weinstein originially appeared in The Green Thumb *magazine, Vol. 46, No. 1 (Spring-Summer 1989), p. 13. – Ed.]*

Neither mowed nor raked, but grown for full development of form, flowers and fruits are the ornamental grasses. Of approximately 40,000 species of grasses on earth, 100 have been selected for use in the garden.

Grasses are among the most adaptable plants in existence. They grow in a wide range of habitats and are major components of the tropical savannas, mid-latitude prairies and the tundra. They are used for lawns, hay, erosion control and are among the most important food crops of the world, including rice and wheat. Most recently, they have been revitalized and elevated to a place in the garden.

Their uniqueness in a garden results from the textural contrast they provide. Their leaves and flowers are generally finer and more delicate than other plants. Because the flowers are small and lack strong colors, they often create a cloud-like effect. The combination of their many leaves and fineness of texture shuffled by the wind adds motion and sound to the garden. To the flower arranger, many of these grasses are significant for compositions, fresh or dried.

The low maintenance of ornamental grasses speaks as highly for them as their beauty. They are widely adaptable to soils and growing conditions, require minimum amounts of moisture and are practically pest free. They have dense, fibrous root systems that rejuvenate quickly. Their growing points are near or at the ground surface, protected from the fickleness of the atmosphere. Grasses are wind pollinated, fragrance free, lack bright colors and do not attract insects. Therefore, they can successfully be established and set seed independently of insect populations.



Erianthus ravenae
Photo: Charles Mann

Ornamental grasses can be grown for attractive foliage, color, texture, growth habit, flowers, fruits, fall color and winter form. They range in size from a few inches high to 20 feet. Some grow in shade but most prefer full sun. Equally attractive in mass as they are alone, they can be bedded out or used as a mainstay in a perennial garden. When the killing frost lays down the perennials, the ornamental grasses still stand, displaying shades of golds, browns and reds.

Andropogon gerardii
Photo: Charles Mann

To select the right grass for the garden, understand its growth habit. Many grow in bunches and break new buds at the base near the crown. Others have creeping stems that may travel beyond the desired limits. These are the ones to avoid or contain so that they do not invade territory where they are unwelcome.

The following list describes the ornamental grasses displayed at Denver Botanic Gardens. Perennials are available from local nurseries. Seeds for annuals can be ordered through many seed catalogs, available for reference in the library.

Perennial Grasses

***Andropogon gerardii* — Big Bluestem**
Grown in the Plains Garden as part of the Tallgrass Prairie, it has been easy to establish. Its most outstanding feature is the bluish foliage that turns to shades of bronze; from 4 to 6 ft.

***Arrhenatherum elatius* var. bulbosum 'Variegatum'-Bulbous Oat Grass**
Cream colored flowers; green with white striped foliage, the most ornamental feature; upright to open; no fall color; best in partial shade and in cool soils of spring and fall; common name from the bulbous nodes on the roots; from 12 to 16 in.

***Bouteloua gracilis* — Blue Grama**
A native to short and midgrass prairies; flowers clustered in flag-like projections; color from tan to red; adaptable, serviceable plant as an ornamental, prairie and turfgrass; from 8 to 14 in.

***Calamagrostis arundinacea* — Feather Reed Grass**
A clump forming grass; flowers green to pink to tan; foliage and form are delicate, upright and refined; tolerates most soils; sun or partial shade; attractive in foliage, flower and fruit; flowers good in arrangements; from 3 to 4 ft.

***Chasmanthium latifolium* — Northern Sea Oats**
Flowers green fading to tan from summer through winter; upright to arching; best in partial shade and well drained soil; outstanding grass for dried arrangements; from 2 to 3 ft.

***Elymus arenarius* — Blue Lyme Grass**
Flowers tan, not ornamental; foliage steel blue, glaucous; aggressive; must be seriously contained, by valuable for its foliage; from 2 ft.

Adding a Bit of "Wild" to Your Garden

Samething abaut mast ornamental grasses lends a "wild," ar naturalistic laak wherever they're gathered. There are those that, in their symmetry or imposing height, wauld not rustle a leaf on being introduced to a formal-garden party: feather reed grass, blue aat grass or ravenna. But mast are attired far trailside picnics.

How abaut designing a perennial bed with some specimen grasses for a tauch af wildness in its attitude? Or introducing some informal perennials into yaur ornamental grass display? Here's a start-off list of shawy perennials and perennial grasses ta transfarm a corner of yaur yard inta a tall meadaw. Grasses: little bluestem, switchgrass, Indian ricegrass and – in the backgraund – maiden-grass. Accompanying perennials: nadding Asiatic hybrid lilies, mariposa lily, pink nadding anion, spatted gayfeather, purple cane-flower, blue flax and tulip gentian.

Miscanthus sinensis and [foreground] *Imperata cylindrica*
Photo: Charles Mann

***Miscanthus sinensis* — Maidengrass**
Attractive silvery to tan flowers; upright habit; fine to medium texture; winter habit outstanding; prefers full sun; attractive for fall flowers; excellent for cutting; many selections; from 4 to 8 ft.

***Molinia caerulea* 'Skyscraper'— Purple Moor Grass**
Flowers yellow in 2-3 ft. spikes; foliage light green; upright form; fall color outstanding golden yellow; winter form succumbs to heavy snows; from 2 to 3 ft.

***Panicum virgatum* — Switchgrass**
Native to tallgrass prairie; flowers dark red purple fading to tan; foliage green to blue; form is upright and narrow; fall color light to bright yellow; flowers excellent for drying; many selections; from 3 to 6 ft.

***Pennisetum orientale* — Oriental Fountain Grass**
Tall; clump form; fine texture; flowers pinkish to purplish; delicate, refined plant; excellent in mass; from 24 to 30 in.

***Erianthus ravennae* — Ravenna Grass**
Flowers silvery white; foliage coarse; upright-open; fall color brown to tan; prefers full sun; outstanding for flowers and form; excellent for cutting; blooms in late August to September; can be somewhat aggressive; from 10 to 12 feet.

***Helictotrichon sempervirens* — Blue Oat Grass**
Flowers tan, not ornamental; foliage light, steel blue with fine texture; tufted, clump forming; full sun to partial shade; most attractive for its foliage and form; from 2 to 3 ft.

***Holcus lanatus* — Velvet Grass**
Flowers cream color; foliage soft, green and silky; somewhat open and floppy; best in late spring for flowers; from 12 to 15 in.

***Schizachyrium scoparium* — Little Bluestem**
A native grass in mid- to tallgrass prairies; upright form; flowers tannish; bronze fall color; good for prairie, ornamental and cutting; from 18 to 36 in.

***Sorghastrum nutans* — Indian Grass**
Native to tallgrass prairies; upright form; medium texture; outstanding yellowish flowers and golden fall color; good for cutting; from 3 to 6 in.

The Not So "Minor" Bulbs

by Claire Norton

Claire Norton, author of a nationally distributed book on growing bulbs, taught at Colorado Agricultural and Mechanical University (now Colorado State University) and, with her husband Mark, maintained a nursery and garden shop at Laporte. Her gardening columns in The Denver Post were published under the pseudonym "The Perennial Gardener." Her articles appeared also in House and Garden, American Home and other magazines. ["The Not-So-'Minor' Bulbs" by Claire Norton originially appeared in The Green Thumb *magazine, Vol. 8, No. 4 (April 1959), p. 16. – Ed.]*

When we turn the calendar to April, we know, in Colorado, that once again the garden is stirring into life. And when we find in some sheltered nook the flaunting bubble of a crocus, or an early squill, or even that venturesome tulip, *Tulipa kaufmanniana,* we are assured the round of color and beauty for which we have been waiting is at hand.

The so-called "minor" bulbs usher in the spring for any gardener to fortunate as to have captured for his garden these gay sprites. Just why they are called "minor" when they are so important to the early garden, I have never been able to determine; nor yet why we gardeners put off from year to year buying them in quantity. Their initial cost is small, and there is no expenditure for upkeep. Given a spot where they can settle in happily, their little colonies increase in size, year after year. Perhaps it is because we do not know these flowers from bulbs so well as tulips and daffodils, and in the fall when we should be getting them underground, we are thinking of other things.

Snowdrops are among the first to show and may bloom as early as January some years. Old-fashioned they are but ever a delightful surprise to find when thoughts of gardening are but lazily rousing. Most gardeners have known since childhood the white bells of *Galanthus nivalis,* almost twice as large is the later blooming *G. elwesi,* and there is a double variety, *G. nivalis flore pleno.*

Less familiar, but sometimes met with in Colorado gardens, are the snowflakes. *Leucojum vernum,* the spring snowflake, is earliest to bloom, eight inches high, white with green tipped petals. The summer snowflake, *L. aestivum,* blooms in May or early June, is taller and yellow tipped.

The dwarf squill, *Scilla sibirica,* can always be counted on to produce its lovely deep blue by the time the crocuses are beginning to stretch upward their chalice blooms. It will probably still be making a gay note of color when the daffodils open their buds. Nestled against a rock, a colony of these squills is inspiring. By May, the taller, more robust squills, known variously as wood hyacinths and English blue bells, will be around. These grow up to as much as fifteen inches in height and come in shades and tones of blue, of white, and of pink. Bulb catalogs list many named varieties of *Scilla campanulata,* or *hispanica,* and sometimes of *S. nutans.*

Grape hyacinths like Colorado as well as do we gardeners, especially the one sold as *Muscari armeniacum,* or Early Giant. Putting up its foliage in the fall, it is ready to burst into bloom with the first real sign of spring, displaying its cobalt bells along sturdy stems often a foot tall. And next year there are a dozen where one bulb was planted. There are many, many more grape hyacinth species and varieties, with Heavenly Blue heading the list as familiar to the garden-minded public. The Feather hyacinth, a *Muscari* with narrow petals forming a plume-like spike, is one to try for something different in the spring garden.

Chionodoxa, glory-of-the-snow, and *Eranthis,* winter aconite, are two "minor" bulbs with which I have not had much luck. For some reason they always disappear after a season or so, though listed as perfectly hardy. Spring starflower, *Tritelia,* is another that has failed me, but it might do with

Iris reticulata
Photo: Robert Heopes

protection. That little iris, *I. reticulata,* also wants a very protected spot, and does not like what March can sometimes do to it here.

The guinea-hen flower, *Fritillaria meleagris,* is both hardy and quaint. We should have some of this around just to bring a smile when things are not going quite right with spring garden work. And Virginia bluebells, *Mertensia virginica,* listed with the bulbs—how can any garden be without its beauty when daffodils and tulips and trilliums bloom? It is a choice addition to the shade border.

Crocuses have an appealing way about them, whether they are the rather opulent Dutch or the fragile, ethereal wild species obtainable from bulb specialist. Never should they be planted in twos or threes here and there. They show to advantage only in large groups or informal drifts of their own kind.

The daffodil or *Narcissus* tribe has some small members that should be considered among the not so "minor" bulbs. The hybridizers have been at work on the *Triandrus* and *Cyclamineus* groups to give us some delightful new varieties. Then there are the true jonquils together with their hybrids, and those quaintest of all flowers that come from bulbs, the hoop petticoat daffodils. These latter are not as easy to grow, making their foliage in autumn and liking especially dry summer conditions. *Minimus, minor, nanus, cernuus, juncifolius, tenuior* are other names for which to watch in the bulb catalogs.

For the gardener who wants something different in tulips, the Botanical or Species tulips offer a wide field. Water-lily tulip, *Tulipa kaufmanniana,* is strictly reliable, early blooming and lovely. Little lady or candystick tulip, *T. clusiana,* is very choice but prefers a sheltered spot with winter protection for safety. *T. sylvestris* is sweetly fragrant and blooms in late April and early May. There are others to be found in bulb lists and are worthy of trial.

Trilliums should not be passed lightly by, particularly if the garden has any shade to offer. For at least partial shade and a deep rich loam is their preference. The Eastern white wood lily, *T. grandiflorum,* is most generally offered, and is beautiful. One of the best varieties we have had for Colorado gardens hails from the Pacific Coast, the *T. sessile californicum.* We grew this successfully for several years at an altitude of 9,200 feet. It is the most fragrant of its family.

Another native bulb genus with a lot of merit is represented by the Erythroniums. These from the West Coast are by far the showiest, but our native Rocky Mountain snow lily, *E. parviflorum,* deserves cultivation. The Eastern *E. americanum* is sometimes met as is the harder to come by *E. albidum.*

The star tulips or pussy ears Calochortus bloom early in the spring, and the eight-inch, fragrant lilac *C. lilacinus* proved hardy for us high into the mountains. It offers an unusual rock garden subject.

What garden can be without lilies-of-the-valley for late spring bloom? Here again we have a bulb flower that takes to partial shade. White is the common valley lily met everywhere, but the variety with bells delicately tinted pink is worth hunting. Together, a colony of these fragrant flowers along a shaded path is something to remember.

So there they are, a sample of the not so "minor" bulbs. Few of them are finicky about their diets. They thrive and bloom and increase in any good garden soil, with a minimum of care. Without exception they are planted in early fall, as soon as they can be obtained from the dealers. A light mulching spread late in December to keep the ground shaded and their foliage underground until safe in the spring will be advisable the first year. Most of them appear to become acclimated by the time a second spring rolls around and take care of themselves without even this coddling. And what dividends they pay on the money and time invested in them!

Nature Does Not Plant Things in Rows — or naturalistic spring bulbs

by M. Walter Pesman, Landscape Architect

M. Walter Pesman, a native of Holland and graduate in landscape architecture at Colorado A&M, was a founder of CF&HA. For many years he was a partner of landscape architect S.R. DeBoer. During the Great Depression DeBoer concentrated on designing and landscaping Denver parks and private residences; Pesman worked on Denver public schools and roadside parks for the Colorado State Highway Department. He landscaped the grounds of East and South high schools as living laboratories for botany teachers. In his honor the U.S. Forest Service dedicated the M. Walter Pesman Trail on Mt. Goliath. His book Meet the Natives, a valuable amateur botanists' guide to Rocky Mountain wildflowers, was recently revised for a ninth edition. ["Nature Daes Nat Plant Things in Raws – or Naturalistic Spring Bulbs" by M. Walter Pesman ariginially appeared in The Green Thumb *magazine, Vol. 12, No. 7 (Sept. 1955), p. 11. – Ed.]*

Should a garden be an improvement over Nature?" This is a question that has bothered garden lovers ever since the "naturalistic" type of landscaping was first proposed in the beginning of the eighteenth century. Not until man perceived the beauty of nature did our gardens change from straight lines, formal planting, and man-made designs.

This appreciation of nature "in the raw" came to the Orient much, much earlier, as reported by the monk Odoric, who went to China in 1325. England was the first country to apply it in its gardens, and now most countries have both "formal" and "informal" gardens. It is mostly a matter of degree: to what extent is our garden predominantly "man-made"; where do we allow nature to take the lead?

Tulips and other spring-flowering bulbs have mostly been used in formal beds, planted at set distances. Even when planted in so-called informal borders—in drifts—the general effect is man-made. How can we achieve a more natural result?

There is a much-quoted method for planting in line with nature's arrangement. Applied to tulip bulbs., for instance, it goes like this: gather up fifty or more bulbs in a wicker basket, stand close to the place where you want them planted, then with a deft semi-circular motion throw them all out in one zoop, and plant each one exactly where is lands. Some will fall close together, others will roll on for a distance, the farthest ones

Photo: Netherlonds Flower Bulb Information Center

may be very scattered; no matter, that is the way nature itself scatters its seeds and plants. It will be effective.

Don't worry if some bulbs are crowded, let them come up like that. (Did you ever examine carefully how nature's own "drifts" are made up?)

Incidentally, this method of planting is quite satisfactory to the artist-gardener, who insists that his flowers be arranged in the garden with the same nice feeling as they would be in a table arrangement. A "drift" in the flower border corresponds to the "spray" idea in an unsymmetrical bouquet.

Carrying through this same idea, why not have a "repeat" in your design: the same tulip might be used in two or three spots, with the proviso that the spots are of varying size and shape. It catches the eye pleasantly and it provides color without monotony.

So far we have talked about bulbs in the border. There is no reason why they should be confined to the border proper. Some of the most satisfying effects can be had by groups of bulbs that seem to come up as volunteers in the most unexpected places. I am reminded of a little cluster of Clara Butt tulips that peeked around a few spirea bushes, most effectively. And where was it that I saw a compost heap virtually invaded by an army of grape hyacinths?

One of the most grateful bulbs in this naturalizing is the little Siberian squill (Scilla sibirica). Once you have it started it will spread in the inimitable manner of nature. I planted a few among a neglected shrub border of coralberries, Japanese barberries and Flowering Almond. The first year I was careful not to disturb them. Now I pay them no heed and they have spread over a radius of twenty feet. Evidently their seed is actually propelled on ripening, at least it is coming up in the most unexpected places just where I want them most. Shade seems to be no obstacle, since it comes out so early in spring.

Much more difficult to get established, but eminently worth the trouble, is our Snowdrop (Galanthus nivalis). It must have shade even in less sunny climes, and in Colorado is not too happy unless it is planted in a woodsy area, possibly with some soil acidity.

Once we have had success with this idea of acclimatization of bulbs, we are prone to try it with various kinds of bulbs. Usually the result is good—as long as we keep our good common sense. I'll never forget one case where I was carried away with the idea of a large mass of yellow daffodils in a naturalistic setting, among cottonwoods. The fact is I had seen beautiful pictures illustrating just that. It was like a dream,—that is, the picture was.

Our reality was devoid of all satisfaction. Yes, the daffodils came up, dreds of them. But just at the time they were at their best,—here were not dreds, but thousands of dandelions competing with them: the same color, the same season. I found out how a dog feels when he slinks away with his tail tucked in.

Another nice idea in theory does not work out too well in reality, namely dotting a lawn with crocus, in the pleasant English manner. It works all right for one spring in Colorado. We are too lawn-minded here to allow our crocus to complete their growth in an unmowed

Lawns for Naturalizing Bulbs

The trouble with bluegrass lawns as backgrounds for naturalizing bulbs is our rush to over-stimulate them with high-nitrogen fertilizers in early-spring, then their subsequent need for early mowing to keep them in conformity with other neighborhood bluegrass lawns. But an alternative lawn setting for bulbs is at hand.

Homeowners with lawns of blue gramma and buffalograss not only can save time and money on their care, but have the opportunity to enjoy springtime carpets of naturalized bulbs.

For a perfectly lovely flowering spring meadow, plug in multicolored drifts of crocus – either species or the larger flowered hybrids – and blue Iris reticulata or sparkling yellow I. danfordii. By the time your blue gramma-buffalograss lawn is ready for its first mowing – if, indeed you ever mow it – the foliage on your early-flowering bulbs will have already pumped the bulbs with next season's flowering energy.

*There's a drawback, especially in young lawns with weed-grass problems. March is the only time to safely spray the herbicide *Roundup to kill early-greening rhizomatous grasses, such as orchardgrass – but that's just when your bulbs are coming up to bloom. The bulb foliage can become an unintended target of the herbicide. Put off planting bulbs in your blue gramma-buffalograss lawn a few years, until you've taken care of the weed grasses, which have greater difficulty invading established turf.*

lawn, as they do in England. Keeping the lawn trim cuts the crocus foliage and the new bulb does not have time to form. The result is that we have to add another couple of dred the next fall if we want to realize the picture in our mind. That is rather expensive.

On the other hand, scattering crocus at various odd spots is most soul-satisfying. Those first yellow crocus suddenly appearing are making us feel that spring is right around the corner. Then come the dark purple and the other colors, one after the other. Except in the lawn, they'll complete their growth and the foliage will disappear without being noticed. (That is where a narcissus is less accommodating; even if we tie up the ripening foliage in neat bunches, it is far from inconspicuous in a flower border.)

Before mentioning the scores of other less-known spring bulbs, let us come back to our tulips and narcissus, the good old standbys.

It is true that they can be used for staid borders,—the early low tulips are particularly good for that. On the other hand, the naturalistic planting has unlimited possibilities.

I remember one satisfactory planting of tulips where the colors and sizes had been so carefully chosen as to make a perfect gradation from low creamy and yellow, through the medium-sized pinks and reds to the tallest breeders with the dark maroons, mahoganies, and metallic purples. To make is a success, intimate knowledge of the varieties is needed.

Luckily there a few color clashes among tulips! Even the gorgeous Red Emperor is not too difficult to blend with others (But why not give it a spot all to itself?)

Lately the so-called "botanical tulips" or "tulip species" are beginning to show up in our gardens. They fit our dry climate, since many of them come from dry sunny locations in Asia Minor, Greece, Central Asia, and similar places. Put them in the rock-garden or in warm nooks. Some are merely "cute", others most striking.

Close to two dred tulip species have been described. Some of the common ones now in the trade are *Tulipa clusiana*, sometimes called "Candystick"; *Tulipa Kauffmanniana* or Waterlily tulip; earliest of all *T. eichler*i with large red flowers and yellow and black center; *T. biflora* with twin-flowers (white); *T. saxatilis* or Cliff Tulip another winner with wide-open lilac flowers showing a yellow sun in center; *T. acuminata* or Turkish Tulip with spider-like, yellow-orange blooms; *T. persica* (patens); *T. turkestanica*; *T. kolpakowskyana* — all named after the place they came from originally — and many others.

If you want to get an idea of the multiplicity of these types, take a look at Wayside Gardens' latest [fall] catalog. They are shown in color.

Even narcissus has gone in for species. Most of them are smaller and particularly good for rock gardens. Some highly amusing.

The following narcissus species are now in the trade: *N. bulbocodium* or Petticoat Daffodil (should be quite popular now that petticoats have returned); *N. juncifolius*, with narrow leaves; *N. Triandrus*, known as Angels-Tears, and of course, *N. jonquilla*, the fragrant Jonquil with a number of flowers on one stalk.

(It will take constant hammering on gardeners to make us remember that a jonquil is not the same as a daffodil, but that both are called narcissus).

If you are interested in the numerous spring bulbs — and who isn't once you have seen them — try them in your garden.

All of them are best in irregular plantings, for — "nature does not plant things in rows."

Tips on Bulbs

- *Check with your supplier: make sure your bulbs are only from cultivated stock, not wild-collected. It's the law: Bulbs must be labeled as to their origin.*
- *A general guideline for planting depth: Plant them about four times their diameter deep. If they are the kind that have a pointed end, the point goes up.*
- *The flowers of bulb plants last longer if they are planted in protected areas, where temperature fluctuation is not quite as great as our weather.*
- *As novelties, there are a couple of fall blooming crocus that grow and bloom well here (although often under November snow):* Crocus sativus, C. pulchellus *and* C. speciosus.
- Chionodoxa luciliae *is a lovely blue or pink companion to forsythia.*
- *Any bulbs planted under deciduous shrubs receive plenty of sunlight in spring and are less likely to be accidentally disturbed by digging later.*

The World of Wild Irises

by Panayoti Peter Callas

Panayoti Peter Callas, now known throughout the horticultural world as Panayoti Kelaidis, began playing with plants as a child in Boulder – and has never stopped. As curator of DBG's Rock Alpine Garden he has shared his enthusiasm for all things botanical in lectures from Oregon to England and in dozens of published articles. His love of plants is monumental, but his special interests are penstemons, plants of South Africa and plants of the West and similar continental climates. ["The World of Wild Irises" by Panayoti Kelaidis ariginially appeared in The Green Thumb *magazine, Vol. 39, Na. 1 (Spring 1982), p. 9. – Ed.]*

Iris bucharica var. alba
Photo: Robert Heapes

Iris danfordiae
Photo: Robert Heapes

A gardener who knows only tall bearded irises might be compared to a person on a diet who samples only a single course at a lavish banquet. The smorgasbord of iris species is vast and varied. Some three dred species occur throughout the northern hemisphere, from icy tundra to parched deserts. In a garden, one or another sort of wild iris could be found to grow in almost any microclimate one can contrive. The name *Iris* derives from the ancient Greek word for rainbow; and just as gorgeous hybrids come in a rainbow spectrum of colors, so do many wild species. Even more variable than flower color is the infinite variety of flower form and growth habit. For example, in eastern Europe *Iris pseudacorus* L. grows over two meters tall along a streamside; while nearby a steep hill might be carpeted with mats of yellow, purple and blue dwarf bearded iris barely three inches tall. The wild blue flag, *I. versicolor* L., can grow four feet tall near mats of prostrate crested iris, *I. cristata Solander*, or vernal iris, *I. verna* L., which form extensive carpets in eastern woodlands of America.

Wild irises are not limited to Eurasia and eastern United States. What Colorado wildflower lover has not delighted in finding our native Rocky Mountain iris filling a mountain valley or broad parkland with its limpid blue pools of color?

The Rocky Mountain iris, *I. missouriensis* Nutt., named for the river along which it was discovered, is the only iris that occurs naturally throughout the extensive Western Intermountain Region, the Rocky Mountains and the High Plains. In Colorado it occurs from the lower fringes of the foothills zone to the upper limits of the tree line. This wild iris is one of the few native wildflowers that has probably increased its acreage since the advent of white man. Cattle and sheep avoid eating its toxic foliage; as a result overgrazed pasture land often presents glorious displays of this lovely flower.

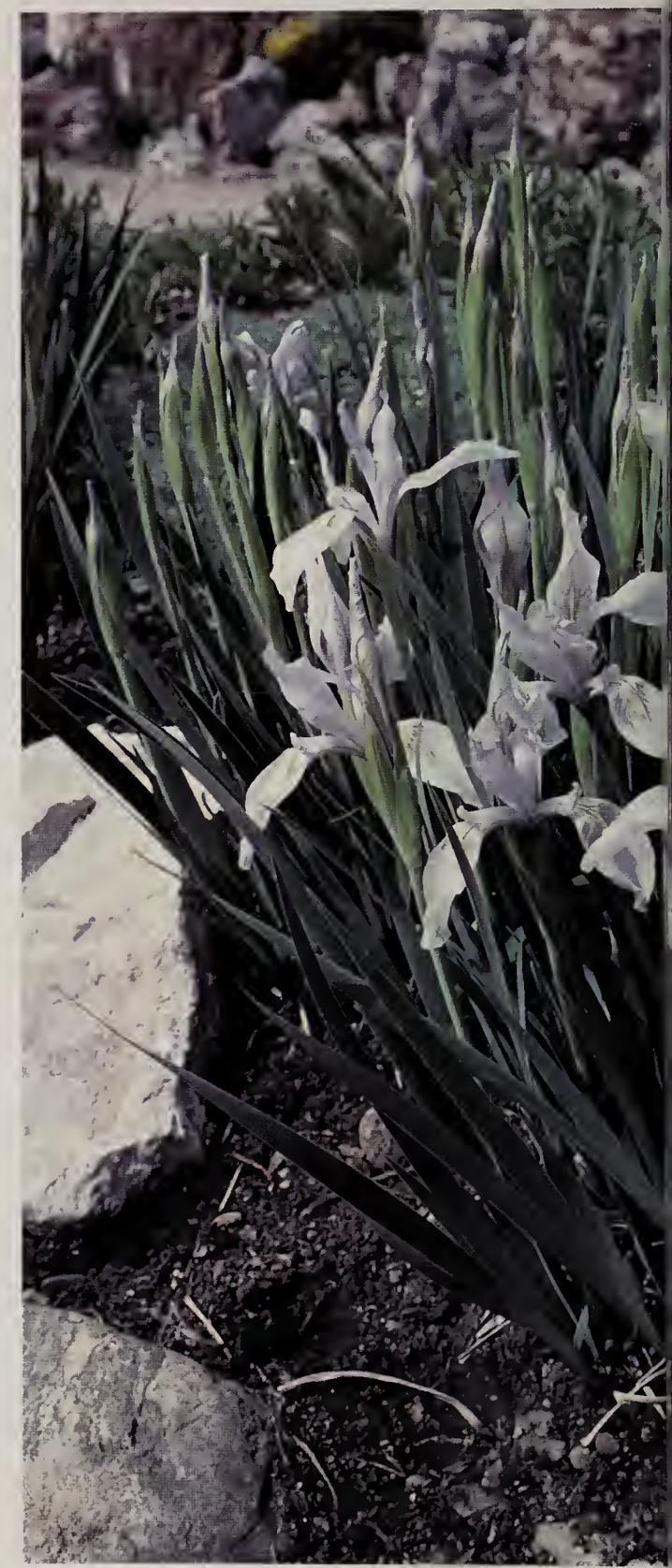
Interesting color variations of the Rocky Mountain iris, including albinos and a deep purple clone, have been selected to grow in the Rock Alpine Garden. This garden was conceived as a place where plants adapted to stressful environments such as alpine tundra, desert, cliff and bog could be tamed in a garden setting. Only a handful of wild irises are adapted to Arctic and alpine environments, but many species grow on the high, dry plains of central Asia. Most of these are truly dramatic in growth form and flower color; and some are being grown in the Alpine House and on the dry steppe portion of the Rock Alpine Garden adjoining the Plains Garden. Most irises, however, are woodland or streamside plants from climates with moderate rainfall. At present approximately seventy species of irises are growing in the Rock Alpine Garden. Let's take a casual walk through the garden located in the southwest corner of Denver Botanic Gardens and preview its beauty in the coming months. We will have to rush a bit, for the season of wild iris bloom is rather long; most years reticulate irises will bloom in February and the vesper iris not until August.

As we enter the garden to the left we will see several of the crested irises (section Lophiris). We are confronted with *I. tectorum* Maxim. in both the blue and white forms. A vigorous and carefree plant in Colorado, it is found

in many local gardens where it will thrive under most any garden regimen. A vigorous and carefree plant in Colorado, it is found in many local gardens where it will thrive under most any garden regimen. Called the Japanese roof iris, since early travelers to Japan reported that it grew on the thatched huts of those islands, botanists believe it is actually Chinese in origin. A close relative is *I. japonica* Tb., a lush, evergreen species which produces long panicles of pale, frilly, orchid-like flowers. This iris, too, is apparently Chinese in origin, although it currently occurs spontaneously throughout most of the lowland regions of Japan. The clue to its origins ins the fact that this Japanese crested iris never produces viable seed in Japan. The millions of plants throughout the islands apparently originated from a single, sterile importation. Unlike the hardy roof iris, it is only marginally hardy in colder regions.

As we continue along this montane slope, with its woodsy soil and shade from young paperbark and amur maples, we encounter another crested iris. This is the crested iris, *I. cristata* Solanderin three color forms, that has woven an almost impenetrable mat under these trees over the last two growing seasons. Its low leaves are broad and pale green, forming a lovely ground cover in summer. This is fortunate, for the flowers are often criticized for being ephemeral. The crested iris invariable blooms during the two or three week rainy season Colorado seems to have perennially in May. During these weeks, there is an almost constant progression of the striking, flat flowers that have an icy, translucent color in the blue forms and an ivory texture in the albino. The eastern crested iris has proven a good plant for a variety of sites in Colorado gardens but needs a certain amount of hand weeding and replanting every three or four years to maximize blooming.

Several robust clumps of *I. graminea* L. occur in the background of the montane slope. Few visitors can enjoy the flowers, but it will reward those who seek them out buried deep in foliage, for the waxy spuria blossoms smell exactly like a ripe plum. Although rather widespread in the eastern Mediterranean region it adapts to a surprising variety of sites in local



Iris missouriensis
Photo: Robert Heapes

Iris tectorum
Photo: Robert Heapes

gardens blooming in late May. It tolerates full sun in rich soils even managing to grow in full shade if provided with adequate moisture.

A number of unusual, inter-sectional hybrids occur along the path from here to the summit of the garden. These are the so-called "Cal-Sibes", hybrids between the Pacific Coast irises (series Californicae) and Siberian irises. All of these hybrids were produced by Jean Witt of Seattle and appear to be vigorous in Colorado. They possess the lustrous, glossy, semi-evergreen foliage of California irises with the vigor of Siberians. The hybrids you will see include 'Fine Line', 'Summerland' and 'Velvet Pennant'.

Looking to the west of the path at the scree mound opposite the montane slope, you will notice several species of dwarf bearded irises, that supreme section of the genus for rock gardens. The dwarf bearded irises are the most prevalent wild iris in southern and eastern Europe, where they occur from the higher elevations in Greece, Italy and southern France to the very margins of the Mediterranean Sea. A number of species have been planted throughout the Rock Alpine Garden, beginning with the tiniest of bearded iris, *I. sauveolens* Bossier & Reuter which occurs in a variety of colors and sizes throughout the Mediterranean basin. This iris can be distinguished from other dwarf bearded iris by its tiny stature and sickle shaped leaves, and by its difficulty of cultivation. *I. reichenbachii* Heuffel grows a little further along on this same mound. Much larger in size and more robust, it forms sizable patches in a brief period of time. Primarily Balkan in distribution, this dwarf bearded iris blossoms in a wide range of yellow and purple tints. Our plant is a bronzy yellow-flowered form which will grow under various conditions in cultivation.

Moving onto the fell field and the north slope we come upon *I. setosa* ssp. canadensis (M. Foster) Hulten, a reputedly dwarf variety of the Labrador iris although it is only six inches or so smaller than the Alaskan forms. This subspecies is prevalent in Labrador and extends to northern Maine on the eastern seaboard. *I. setosa* Pall. ex Link is one of the most widespread of irises, occurring in Siberia, northern Japan and most of the Arctic reaches of North America.; While the Labrador iris has been in the garden for only two years, each clump produces dozens of flowers over a six-week period. It is sure to attract attention in June, as it overlaps with tall bearded irises in blooming period. The smoky, gray-blue flowers are not nearly as showy as the Alaskan form of the same iris found further along this slope; but to sophisticated tastes, a clump of Labrador iris in bloom is second to none.

Another few paces along this slope grow some robust plants of *I. bracteata* Watson, one of the lesser know native American irises belonging to the series *Californicae*. It is reputed to be a difficult plant to grow in many parts of the United States, but given an acid soil rich in humus with a sunny exposure and mulched with pine needles this has proven a reliable garden plant in Colorado. It has lustrous, evergreen foliage of a very waxy and almost succulent texture. The orchid-like yellow blossoms are produced in pairs in late May and June—lasting for several weeks on an established clump. Unlike bearded iris, the Pacific Coast native irises do not like to be disturbed. In our climate, a clump can persist for several decades without needing division.

Further along the same side of the north slope is one of the greatest prides of the garden, a large bed smothered with *I. ruthenica* Ker-Gawl. This unusual little iris has been found sporadically from eastern Europe all across Eurasia to the Pacific Coast, occurring in a bewildering variety of sites and climates. In our area it seems to grow well in any good garden soil in part shade or sun, forming huge mounds of grassy foliage with an amazing profusion of miniature, jewel-like flowers throughout most of the month of April. In wet climates, the Ruthenian iris can go years without blooming. In Colorado it is a showpiece.

Across the crushed limestone path on the fell field, *I. lacustris* Nutt. has formed a number of dense, diminutive mates. This is one of the tiniest wild irises, rarely exceeding two inches. In nature it was largely restricted to woods and meadows around the margins of the Great Lakes, but vacation home development has almost wiped out this small American wild iris. A difficult plant to grow requiring moisture, lime and humus, it thrives here along the path producing dozens of miniature, sapphire renditions similar to its close relative, *I. cristata*.

Further west along this same slope one can find several large clumps of *I. minutoaurea* Makino., another miniature iris. This one comes from Manchuria and Korea and belongs to the little known series *Chinenses* of the genus Iris. It also produces tiny, jewel-like flowers, but of a pale yellow color, among the grassy tufts of leaves.

I. kamaonensis Wallich ex D. Don is the last tiny iris one encounters on this side of the path. This almost mythical iris is named for the Kamaon or Kumaon region of the western Himalayas, where it can be found up to 15,000 feet in elevation. It is regarded as one of the best of the series Pseudoregelia irises, the highest alpine of all iris species. They form low, blunt-leaved mounds of foliage and produce their strange flowers early in spring. These flowers are usually pale blue, blotched with a bizarre pattern of pink, white and deeper blue.

Iris enthusiasts are invariably surprised and pleased to see how well *I. verna* L. has taken to cultivation in Colorado. In our garden it grows along the crown of the north slope just above the waterfall, forming dense mats of glossy, deep green leaves that bronze considerably under our winter sun. Nevertheless, this eastern woodland iris seems to grow far better here in sun with acid, peaty soil than under any other regimen. It blooms and grows prolifically here.

Around the bend in the path at the summit of the garden, clumps of the native Alaskan *I. setosa* grow along the streambank. There are

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a variety of Pacific Coast native irises growing on the west side of the path, including the yellow form of *I. tenax* var. *gormanii* (Piper) Foster which was once very rare in the Coast Range of Oregon. As more and more of the mountains around Portland were clear-cut, this once rare iris emerged from long-buried seed in ever increasing abundance so that it is now regarded as relatively common. This grassy-leaved iris produces dense tufts of foliage and very large flowers, sometimes five inches across, of a pale, lemon-yellow tint.

Another yellow-flowered Oregonian can be found further down the slope. *I. chrysophylla* Howell, produces many blue-grey or silvery leaves and spidery flowers of a straw-yellow or creamy tint. This is regarded as one of the more temperamental and temporary Pacific Coast irises, although it has persisted with undiminished vigor more than seven years in Colorado.

I. douglasiana Herbert has grown even longer in a number of local gardens. In nature it is restricted to the narrow fog-belt of the Pacific Coast. It has grown for more than 15 years in Allan Taylor's Boulder garden. A number of plants have been established here in the Rock Alpine Garden. It is a rather variable iris with three or four inches wide flowers blooming in June above the deep green, winter-persistent foliage.

On the back side of the boulder field, a large clump of *I. milesii* Foster from China has been established. This is the largest of the hardy crested irises, but one of the least known in cultivation.

Other native irises have been established along the northern slope of the upper seepage area. *I. tenax* Douglas ex Lindley in its most common blue and purple forms is growing among a variety of ericaceous plants on this peat bank. This most common "oregon" iris is one of the loveliest wildflowers of the Willamette Valley. It is probably the hardiest of the Pacific Coast irises, since it is deciduous.

Presently, the only iris growing on the limestone cliffs is the unusual vesper iris, *Pardanthopsis dichotoma* (Pallas) Lenz which was included in the genus Iris for many decades. Iris-like in shape, each flower lasts only a day, opening only in the late afternoon and closing shortly after dawn most summer mornings, so only a few nocturnal insects enjoy its beauty. This strange iris from northern China and Manchuria blooms not only late in the day, but also late in the year, rarely starting to blossom until late July.

On the shady side of the north slope grow large clumps of *I. gracilipes* A. Gray in the blue, white and strangely contorted double form. Sometimes described as the most delicate of irises, it forms a graceful swirl of wispy leaves and a cartwheel of wiry stems with the prismatic inch and a half blossoms quivering atop the clump during most of May. This rare Japanese iris requires shade, drainage, humus-rich soil and moisture throughout the growing season, but once established it is permanent and one of the loveliest of rock garden plants.

Opposite, on the moraine mound, are several unusual bulbous irises. *I. reticul*ata M. Bieb. pierces mates of *Herniaria glabra* L. and *Paronychia kapel*a (Hacq.) Kerner in early spring. These dazzling early spring bloomers, rarely grown by local gardeners, will grow vigorously in a variety of sunny sites in a Colorado garden and are available from local garden shops. Even more striking, perhaps, than *I. reticulata* is *I. histrioides* (G.F. Wilson) S. Arnott var. *major* Grey which also blooms in late winter most years and belongs to the same section of the genus. The flowers in this Turkish iris are sometimes five inches across, and emerge before the leaves pierce the ground. They last remarkably well for weeks on end and through snowstorm after snowstorm.

The juno irises have captivated the imaginations of gardeners from the time that Thomas Jefferson first grew *I. persica* L. at Monticello. Bulbs of this fabulous, sea-blue winter iris are still grown by gardeners; although, regrettably, we have none at the Rock Alpine Garden. Other junos obtained from England can be seen in the Alpine House this spring. One has established itself as a superb rock garden plant; *Iris bucharica* Foster resembles nothing so much as a miniature corn plant with Dutch iris blossoms pinned to the leaf axils. The form growing on the moraine mound is bright yellow in color, and more dwarf in stature than most *I. bucharica* cultivars. In England this iris often exceeds two feet in height, and ranges from yellow to pure white in color.

Iris bucharica
Photo: Robert Heapes

The only iris growing along the stream below the waterfall is *Iris ensata* Tb. grown from seed collected in the wild in Japan. This striking iris has deep purple, yellow-splotched flowers which are much more graceful than its huge flowered "Kaempferi" progeny.

To the north of the moraine, the lower meadow forms a large flat expanse, a pleasant contrast to the rest of the garden's rocky terrain. The simulated stream bisecting the meadow is bordered with several irises and iris relatives. Let's meet them. Clumps of a strange Siberian iris, *I. sibirica* L, grown from seed originating near Brno, Czechoslovakia bloom in late June with coarsely reticulated blossoms. Several large clumps of *I. lactea* Pallas occur along the bank further up the stream. This is one of the most tolerant and adaptable irises that grow in Colorado gardens. The form growing here closely resembles our native *I. missouriensis*. except for its white falls, blue standards and an unforgettable cigarette-lighter fluid aroma. The leaves are far more persistent than our native iris, remaining green and firm well into autumn. It makes a tremendous show for much of May and early June, and seems to thrive in almost any soil or exposure in our climate.

I. missouriensis is found further up in a number of different color forms, from deep blue and purples selected by Allan Taylor from populations near Boulder, to three separate albino clones from three different western states. Other irises growing around the meadow include the dwarf bearded species *I. x barthii* Prodanand *I. furcata* M. Bieb. *I. flavissim*a Pallas flourishes on the warm bank at the top of the meadow.

The northern portions of the Rock Alpine Garden are especially suited to dryland irises such as the arils and junos. Here the soils vary from sandy loams to heavy, alkaline clays with a long summer baking among the limestone cliffs. The first year after planting, *I. hoogiana* Dykes, *I. hoogiana* 'Bronze Beauty', *I. stolonifera* Max-

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im., and *I. hoogiana* 'Purpurea' produced dozens of flowers. In another year the display should be even more impressive. Other aril irises in the garden include I. gatesii Foster, *I. iberica* Hoffm and *I. polakii* Stapf.

This synopsis is just that — a recapping of some of the more noteworthy irises in the garden. Dozens more have been planted from seed this year, or simply have not been tried yet. Herb Schaal, in designing the Rock Alpine Garden at Denver Botanic Gardens, wished to provide the proper soil and drainage, and have efficient watering regimens so that the broadest range of hardy plant material could be grown on this acre of ground. in order to find out just how successful this vision was, we invite you to come by and visit.

Rock Alpine Garden Iris Update, 1996

This article was originally written in 1982 to introduce species iris growing in the Rock Alpine Garden for the annual general meeting of the American Iris Society. Several of the species have not persisted in the spots where they were originally planted, while others have prospered far better than we had hoped: the various Pacific Coast irises in particular are relatively short lived here, blooming well the third year after they are grown from seed, and lasting another three or four years. Iris verna *did well for a few years, but has proven recalcitrant recently, and is no longer in the collection. We have found that most of the crested iris need to be transplanted after a decade or so right after they bloom and be provided with fresh soil or their flowering diminishes.*

The Eurasian beardless irises in the section Lophiris *have been by far the most long-lived and sturdy plants in our collection. We have added other accessions of* Iris lactea, *and the original plantings have sown themselves into wide swathes of color. The* Spuria *section plants are just as long lived, and indestructible –* Iris graminea *now forms huge clumps of bright green in mid spring with deliciously fragrant flowers buried among the leaves.*

Bearded iris have been longer-lived than their fancy hybrids would suggest: We divide these in early summer after they bloom every five to ten years, and have an embarrassment of riches in a few years. Some of the clumps have persisted in their original sites since the inception of the garden – something they would not be apt to do in wetter climates where borers are a severe problem. Their close relatives, the Oncocyclus *and* Regelia *irises from the drier parts of Western and Central Asia need to be divided in midsummer to prosper in Denver. They only survive where they are not inundated by water at any time, preferably where there is little supplemental watering. These are the great xeriscape plants of the genus.*

The bulbous irises have been the best successes in this garden: All the junos planted in the early eighties have been divided repeatedly, and now we have large masses of Iris bucharica, Iris aucheri, Iris magnifica *throughout the garden. The reticulate irises are short lived in wet regions, but here they form large clumps in five or so years. We find they must be divided when the flowers get crowded or the famous "ink spot" fungus can destroy their bulbs: we now divide these just as they finish blooming and their foliage is at its longest you know exactly where the bulbs are then, and they seem to move just as well in full leaf as when they are dormant (and the bulbs are never exactly where you think then: you invariably miss dividing several clumps when they are dormant, and slice in half a good proportion of the bulbs you do manage to find.)*

The value of species iris has, if anything, increased in the subsequent years. Their grassy foliage makes a fine contrast to the prevailings mats and buns in the rock garden, but their vivid flowers in the rich blue and violet end of the color spectrum are perfect foils for practically any other plant that blooms at the same time.

Peonies for Your Garden

by Harry B. Kuesel

Harry B. Kuesel, a long-time member of DBG's board of trustees. was, until his recent retirement, an avid grower of irises and daylilies, often seen planting and caring for them in DBG's York Street collections. ["Peonies for Your Garden" by Harry B. Kuesel originially appeared in The Green Thumb *magazine, Vol. 38, No. 3 (Autumn 1981), p. 74. – Ed.]*

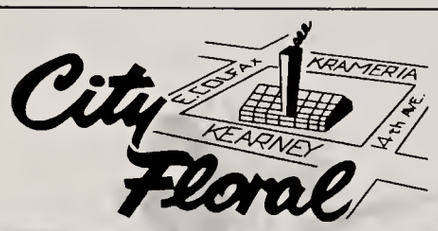
Photo: Charles Mann

The beautiful peony, one of the loveliest of the late spring flowers, is so easy to grow and maintain in the high plains area. This excellent perennial, once established, requires little care and can give most satisfying performance for decades. It is really a long-lived flowering plant.

First let us consider establishing peonies in the garden, and then some of the history of species discovery and horticultural development of the multitude of varieties now available.

Autumn is the best time to plant peonies for the next year's bloom. For planting select a well-drained site with at least a half-day of full sun. Our local soils are generally just right if low spots where water can collect are avoided. When ready to plant the roots, dig a generous hole about 18 inches deep and 18 inches in diameter. One peony-grower advised, "Dig a $40 hole to plant a $4 plant."

Remember the plant can grow there for the next 100 years!



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It is desirable to put 3 to 6 inches of well-rotted manure in the bottom of the hole and cover with at least 3 inches of good garden soil. Next, hold the roots in place and fill in around them with soil to keep them spread in their natural position. Be careful to keep the buds (eyes) near the surface, because if they are planted too deeply it will take several years before the plant will bloom. After watering, if the soil settles so the buds are no more than 2 inches below the surface, sift garden soil or well decomposed compost loosely over them. Mulching with straw or peat is desirable for the first year or two, but once the plant is established this is seldom necessary.

Few diseases or pests bother peonies, but sometimes a fungus known as botrytis will attack. This can be controlled by spraying the tops after they have died down in autumn with a good fungicide like Bordeaux mixture or one of the new synthetics such as benomyl or benlate. It might be wise to spray the buds and soil around them again when new growth starts in spring.

Peony season extends for several weeks with the earliest ones flowering in early May and others not until late June. Occasionally the tree peony lutea hybrids will also bloom in the fall.

Earliest Peonies

Historically an old double red, probably imported during Colonial days, was the only peony known to any extent in America up to the middle of the 19th century. This was the species, *Paeonia officinalis* L., a native in Europe. The generic name, *Paeonia,* comes from Greek mythology. Paeon, the mythical physician, was said to have cured the wounds of Pluto, god of the underworld. This made Aesculapius, teacher of Paeon, so jealous he planned to have Paeon killed. Pluto, however, gratefully thwarted his plot by changing Paeon into this flower which forever after bore his name.

Native to Siberia and North China, *Paeonia albiflora* Pall., really accounts for the peony's increased popularity. During the middle of the 17th century the Dutch East India

Company sent an ambassador to China and reports from the embassy described Chinese peonies in glowing terms. Not until 1805 was the first *P. albiflora* imported to England by Sir Joseph Banks, president of the Royal Horticultural Society. By that time these Chinese peonies had also been imported into Japan and greatly improved. William Prince, an American nurseryman, imported some peonies to Flushing, Long Island, shortly after they reached England and by 1824 he listed over 40 varieties in his catalog.

The only species native to North America is *Paeonia brownii* Doug. which grows in California. It is tender in cold climates and somewhat of a botanical curiosity. The Chinese recognized two species long ago: *P. albiflora,* a perennial with herbaceous habit; and *P. moutans* Sims. (*P. suffruiticosa* Haw. in Bailey, Manual of Cultivated Plants), a woody-stemmed type called "tree peony." Actually the latter is more of a shrub in ultimate form.

Basic Flower Forms

The four basic flower forms which have been identified by the American Peony Society are described as follows:

SINGLE: Five or more petal arranged around the center of seed-bearing carpels and pollen-bearing stamens.

JAPANESE: Five or more petals surrounding abortive stamens, most of which produce no pollen and many sterile stamens, called staminodes. These may actually look somewhat petal-like. This type is sometimes described as "anemone flowered." In the Japanese type the carpels may be normal, hence they are possible seed producers when viable pollen is applied.

SEMI-DOUBLE: Five or more outer guard petals surround a center of broad petals, many of which may have pollen-bearing anthers. These stamens may be arranged in rings or appear in the center of all the petals. The carpels may be normal, or transformed into petals, in whole or in part.

DOUBLE: Five or more guard petals with often no trace of stamens or carpels which have been nearly or completely transformed into "petaloides," small petals. There are at least two sub-types: the "bomb" type with the guard petals shorter than the center ones, giving a globular shape; and the "rose" type, full double, with all petals large and forming a rather flat face.

Interest in peonies in this country through the first quarter of this century centered on garden cultivars selected from natural insect-pollinated crosses. Seedlings from such natural hybrids produced varying results and the most attractive forms were named and vegetatively propagated. *Paeonia albiflora* was the primary source of all such varieties There was little hand-crossing between the various named varieties and still less hybridization between distinct species. Victor Lyman in France and Peter Barr in England developed some early species hybrids, but these were not widely grown in the United States.

New Hybrids

About the time of World War I three members of the American Peony Society, without knowing of each other's work, began hybridizing *Paeonia officinalis* with *P. albiflora.* These three were Edward Auten, Jr., of Princeville, Illinois, Lyman Glasscock of Elmwood, Illinois, and Professor A.P. Saunders of Clinton, New York. These men later inspired fewer than a dozen others to make these same crosses. Mr. Auten introduced some 250 varieties of Chinese peonies and about 50 hybrids between the two above-named species over a period of 40 years. In his opinion his finest Chinese varieties were 'Auten's Price,' 'Mary Auten,' 'Carolina Moon,' 'Nippon Brilliant,' and 'White Delight.' Some of his famous hybrids are 'Auten's Red,' 'Chocolate Soldier,' 'John Harvard' and 'Veritas.'

Mr. Glasscock, during a 35-year period, produced about a dozen Chinese varieties and 50 hybrids. He is most famous for a dark red "bomb" variety called 'Red Charm.' Other fine varieties he developed are 'Golden Glow,' 'Flame,' 'May Delight,' 'Sunbright,' 'Bright Knight,' 'Mahogany,' 'Gay Cavalier' and 'Black

Monarch.' These are all hybrids between the two species just named. In addition, by crossing *P. officinalis* with *Paeonia tenuifolia* L. he produced another hybrid named 'Laddie' which has a very distinctive narrow fern-like foliage and bright cup-shaped single flowers. All of Auten's and Glasscock's hybrids were of various shades of red, mostly ranging from medium to dark but of very clear colors.

New Colors

Professor Saunders was not content to cross only these three species, but set out to hybridize as many different species as he could obtain. He named and introduced over 50 hybrids. While *Paeonia albiflora* served as a parent for more than 80 percent of his introductions, he used several different varieties of *P. officinalis.* A dark crimson form of the latter was used to develop his 'Challenger' strain which created a sensation at the American Peony Show in Boston in 1928. 'Challenger,' 'Buccaneer,' 'Defender,' 'Liberator' and 'Mariner' are some of the better-known cultivars. Perhaps his most famous cross was between *P. officinalis* 'Lobata' (by Perry) and *P. albiflora* which yielded colors of scarlet, cerise, cherry, salmon, vivid pink, coral and flamingo—colors heretofore unknown in peonies. Among the most famous of these cultivars are 'Alexander Woollcott,' 'Carina,' 'Red Red Rose,' 'Heritage' and 'Your Majesty' in pure reds and 'Claudia,' 'Constance Spry,' 'Cythers,' 'Laura Magnuson,' 'Lovely Rose' and 'Ludovica' in pink shades. Another species, *Paeonia decora* G. Anders., a dark red-violet color, and its white form, *P. decora* var. *alba,* were crossed on *P. albiflora,* and this resulted in 'Reward,' a dark red single, and 'Camellia,' a lovely double white rosette with a pale peach tint.

Paeonia macrophylla Stern, a large-leaved species, was imported from the Caucasus Mountains in Asia Minor. This dwarf plant has small cup-shaped white flowers and large coarse leaves. It imparts a strong early blooming tendency to its offspring and thus extends the normal flowering by two to three weeks. The most famous Saunders' offspring from crossing this species with *P. albiflora* is 'Chalice,' an immense shimmering white single. By self-pollinating 'Chalice,' he developed a second generation hybrid named 'Archangel,' equally fine. Then he back-crossed with the *P. albiflora* parent to produce 'Garden Peace,' a distinctive white with bright red stems, and 'Requiem,' a white single with soft leathery texture.

Another species from the Caucasus is *Paeonia whittmaniana* Stev. This is more tender, but Professor Saunders was successful in getting hybrids with *P. albiflora* and *P. whittmaniana.* 'Ballerina,' a creamy white is perhaps best known. *Paeonia emodii* Wall, a tall plant with many nodding small white flowers and fernlike foliage, was imported from the Himalayan Mountains via an English botanical garden. When it was crossed with *P. albiflora,* a most unusual five-foot tall white single resulted and was named 'White Innocence.' Its white flowers have greenish centers are there are several flowers to each swaying stem.

Two other Asiatic species, *Paeonia beresowski* Stern and *Paeonia veitchii* Lynch, crossed with *P. emodii* gave Saunders two similar strains which he called 'Early Windflower' and 'Late Windflower' because they bloom ten days apart. Both of them have white anemone-like flowers which nod gracefully above fernlike

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foliage. *Paeonia mlokosewitschii* Lomak. is another species native to the Caucasus region. It is early-flowering, light clear yellow with unusual light gray-green foliage. Saunders tried for several years to make a cross of this species with *P. albiflora* without success. But Dr. Earle B. White made this cross over 500 times and finally got one hybrid seed. Miraculously the seed was viable and its seedling lived and bloomed with pale ivory-yellow single flowers and foliage midway between its two parents. It was named 'Claire de Lune.' Saunders was successful, however, in crossing *P. mlokosewitschii* with *P. tenuifolia.* This latter species is native to the Crimea and Caucasus regions and has single bright crimson flowers and fernlike foliage. Also there are two variants (mutations) of this species one of which is pink and the other double. The best Saunders obtained from this cross was named 'Gwenda,' a tea-rose-colored single. He then created triple hybrid crosses by mating 'Gwenda' and its siblings with *P. albiflora.* 'Rosellette,' a tall very early single pink, and 'Rushlight,' a single pale ivory-yellow are two fine results. Carrying this line further, he made what might be called quadruple crosses by combining these triple hybrids with *P. macrophylla.* Two of my favorites from this are 'Firelight,' a very early single rose-pink, and 'Starlight,' a pale yellow single.

Professor Saunders also did extensive work with hybridizing tree peonies. The tree peony, *Paeonia moutan,* is native to northwestern China. *P. suffruiticosa* from another part of China is quite similar and is, in fact, considered by some botanists to be the same as *P. moutans.* The flowers are very large, white with purple markings at the base of the petals or all purple. The Japanese imported this species from China

over a thousand years ago and developed it in size and color range from pure white to red to purple and many shades in between. Professor Saunders imported, again through botanical gardens, a single-flowered yellow tree peony species that originated in Tibet called *Paeonia lutea* Delaz. ex Franch. He crossed this with *P. moutan* and its related forms from Japan. The results were spectacular. He got single yellows with and without crimson flares; semi-double and full-double yellows, ruffled and furled; single and double suffused and tinted with rose; single and double reds and single to double dark crimson, maroon with black markings; and finally, ivories and pearled shades suffused with mauve.

In recent years Louis Smirnow, a peony enthusiast, returned to China to investigate a report from a Chines gardener that the old Chinese dynasties never allowed their prized tree peonies to be exported and that there existed blue and green shades of peonies, descendants from ancient Chinese gardens. He successfully brought to his nursery on Long Island three shades of blue and two greens in the lighter tints.

Denver Botanic Gardens now has good specimens of most of these different types of peonies. Included are about two dozen hybrids and Japanese and Saunders "lutea" tree varieties—divisions from those in my garden at Littleton. From the Klehm estate in Arlington Heights, Illinois, 19 patented peonies representing some of the best *Paeonia albiflora* varieties were obtained. Gilbert H. Wild and Son of Sarcoxie, Missouri, generously donated 66 more herbaceous varieties.

For anyone who would like to include peonies in his own garden, a visit to Denver Botanic Gardens to see the peonies blooming should be very worthwhile. With its extensive selection, the peony garden presents a beautiful sight in late spring.

Peonies Have Three Seasons

As popular as peonies are, often overlooked is their beautiful foliage. Nothing says "spring" so sensually as the bright red-marrooon spikes of peony foliage emerging in late March and early April. The unfolding leaves, gradually changing to green, are as beautiful as much appreciated fern crosiers.

Then, in fall, comes the surprise. A long Rocky Mountain Indian Summer coaxes gorgeious displays of gold, russet and scarlet from the leaves before they fade to the ground. And, of course, all summer long the glossy, finely cut leaves provide a textured, dark green foil for summer blooming plants.

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By Susan Eubank, Senior Librarian, Denver Botanic Gardens

Armitage, Allan M. Herbaceous perennial plants: a treatise on their identification, culture and garden attributes. Athens, Ga.: Varsity, Press, c1989. SB 434 .A7 1988

One of my favorite works on perennials for American gardens. Mr. Armitage is very thorough with his research and also likes to tell a good story.

Bird, Richard. Propagation of hardy perennials. London: B.T. Batsford, 1993. SB 434 .B5 1993

This is the only book specifically on propagation of perennials. It has finally brought together much information that had been scattered in bits and pieces in many different sources.

Clausen, Ruth Rogers. Perennials for American gardens. New York, N.Y.: Random House, 1989. SB 434 .C5 1989

In tandem with the Armitage book above, these two sources create the most complete work on the most used perennials in American gardens. This book has wonderful pictures which complement the thoroughness of Armitage's text.

Coates, Margaret Klipstein. Perennials for the western garden: the amateur gardener's fieldbook for the growing of perennials, biennials, and bulbs. Boulder, Pruett Pub. Co., 1976. SB 434 C638

This is the first book written on growing perennials in the Rocky Mountain region. The entries are brief descriptions with very brief culture information. The book includes plants not found in the other books including penstemons, several evening primroses, and lots of sedums and sempervivums.

Harper, Pamela. Desigining with perennials. New York: Macmillan, 1990. SB 434 .H27De 1990

Ms. Harper has written several books on perennials; this one filling the gap of how to design your perennial garden. Her writing style is wonderfully readable and the book goes much more in depth into design techniques than any other perennial book.

Jelitto, Leo. Hardy herbaceous perennials. 3rd ed. Portland, Or.: Timber Press, 1990. SB 434 .J457 1990

This two volume, comprehensive book is written in the best tradition of German scholarship. It contains the most extensive list of perennials with brief descriptions, culture and propagation information. If you can't find your perennial in other books look here.

Perennials: toward continuous bloom. Deer Park, Wis.: Capability's Books, 1991 SB 434 .P4735 1991

Ah, inspiration! Ann Lovejoy, the popular writer for Horticulture magazine, edited this book of essays and articles on perennial gardening. Even reading articles about perennial gardening in the South serves as inspiration for gardening here, because of the quality of the writing.

Phillips, Roger and Martyn Rix. The Random House book of perennials. New York: Random House, 1991. SB 434 .P5 1991

This is another two-volume set. Volume 1 is about early-blooming perennials. Volume 2 is about late-blooming perennials. This book is wonderful photographic journey through the world of perennials. Like Jelitto, the text is sparse, but the photographs illustrate many perennials not shown anywhere else.

Proctor, Rob. Perennials: enduring classics for the contemporary garden. New York, N.Y.: Harper & Row, 1990. SB 434 .P7 1990

Although written for a national audience, our local garden writer extraordinaire includes many perennials appropriate to our own climate. The book is a joy to read and the photographs and illustrations make me believe Colorado gardens can look like English borders.

Springer, Lauren. The undaunted garden: planting for weather-resilient beauty. Golden, Colo.: Fulcrum Pub., 1994. SB 473 .S69 1994

Fortunately Colorado is blessed with more than one wonderful garden writer. This book is another inspirational guide to gardening. And it is written for the Colorado climate! She will guide you through hail, heat and early fall snow storms to grow perennials to their height of beauty.

Strauch, Joseph G. Flowering herbaceous perennials for the high plains. Fort Collins, Colo.: Agricultural Experiment Station, Colorado State University, [1989.] SB 434 .S77 1989

This is another book written specifically for our own climate. I consider it an updated version of the Margaret Coates book above. There is a good mix of natives and non-natives and recommendations for particular cultivars that will be available in our local nurseries.

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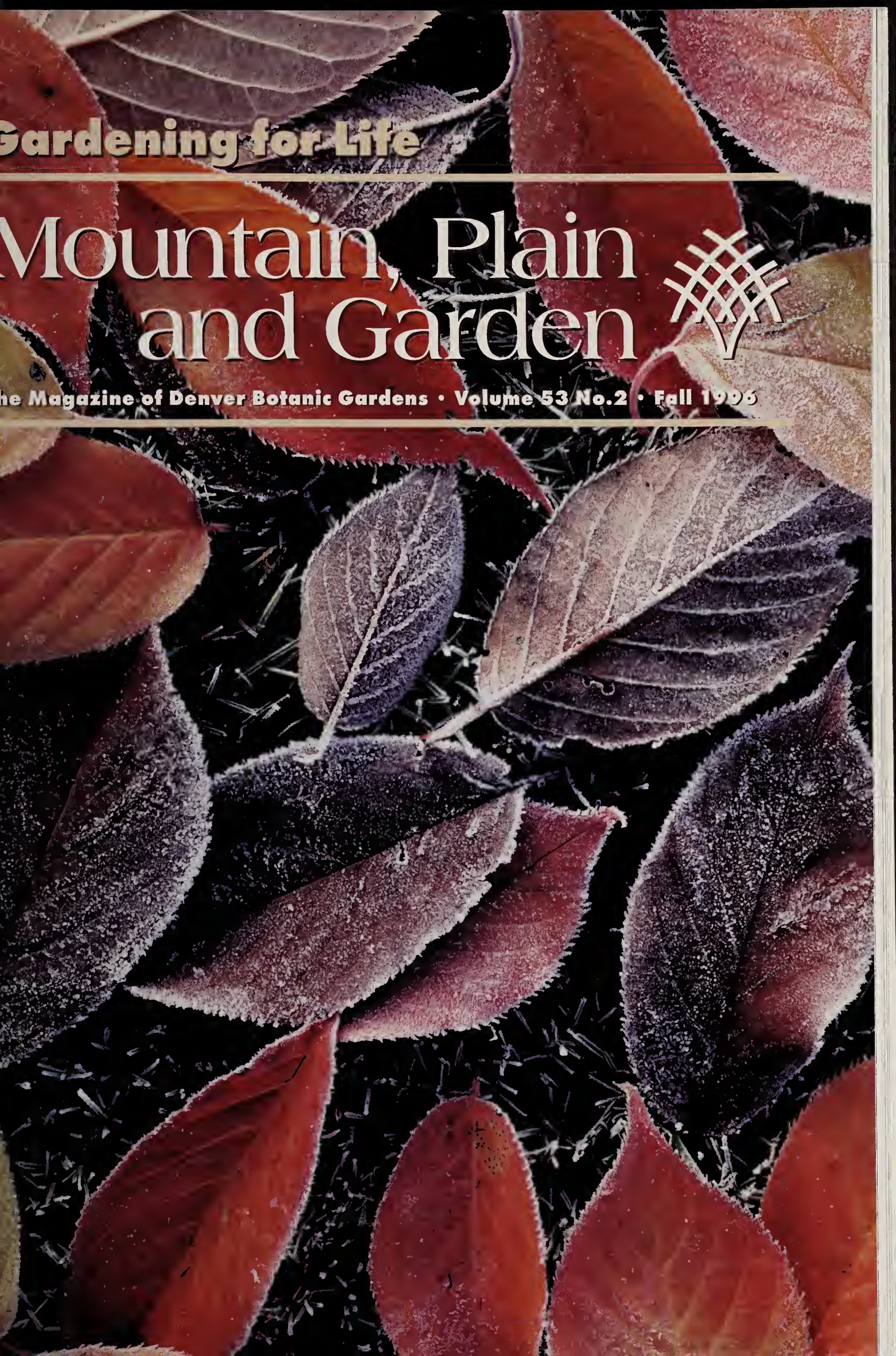

Gardening for Life

Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens • Volume 53 No.2 • Fall 1996

Gardening for Life

Gardening is a lifelong activity—from the time we first walk on our own until we can no longer walk without aid and beyond—providing at each stage of life unique experiences and benefits.

At Denver Botanic Gardens we have developed programs to make gardening and the study of plants rewarding to people of all ages. Our children's programs and those for teachers help the young gain a love for plants they will carry with them throughout their lives. Our adult programs, classes, workshops, lectures, demonstrations and tours of gardens, provide adults stimulation and enjoyment that is not duplicated in other activities in their lives.

For many people who have physical and mental challenges, whether young or old, we have our renowned Horticultural Therapy program that works with people with disabilities and with physical and recreational therapists who help others. Those of us who are able gardeners know how plants touch our lives every day. Through horticultural therapy we can bring this joy to others.

But it goes beyond that. Interacting with plants can be the best way to enrich many lives and can uniquely allow people with disabilities to bring joy and beauty to others' lives through tended plants and gardens.

Plants touch us at each stage of life, and we hope the ideas in this special edition of *Mountain, Plain and Garden* give you new ways to understand and appreciate plants and bring them into your life and the lives of those around you.

Richard H. Daley
Executive Director

For infromation on advertising in future issues of *Mountain, Plain and Garden*, call 303-370-8033.
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Donald J. Kany, president
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Photo p.5, Judy Allen. Children find pleasure in simple gardening tasks.
Photo p.10, Janet Laminack. Children from Anchor Center for the Blind experience DBG's Morrison Center greenhouse.
Photo p.25, Rebecca Haller. Gardening can be an enjoyable activity throughout life.
Back cover photo, Denver Botanic Gardens.

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Green Nature/Human Nature

by Charles A. Lewis

Charles A. Lewis has worked as horticulturist and administrator of the collections program and then research fellow at the Morton Arboretum in Lisle, Illinois. He also has been a plant breeder, grower and garden center operator, and director of a public garden. Now a consultant in people-plant interactions, he has published widely in professional journals and popular magazines and newspapers. *[Copyright © 1996 by Charles A. Lewis. Used with the permission of the University of Illinois Press.]*

Why do gardeners find endless delight in the mysterious germination and growth of a seed? As if enchanted, we water, weed, dig, and dream. Why are our spirits so lifted by flowers, choosing them to mark the meaningful occasions of our lives, both happy and sad?

What compels many of us each fall to behave like lemmings, massing along roads and hiking trails to immerse ourselves in foliage aflame with color? And what draws us so powerfully to savor panoramic views? Highway engineers acknowledge this urge. Knowing we would stop anyway, they construct scenic overlooks where cars can pull off the road without drivers having to risk life and limb.

People and plants are entwined by threads that reach back to our very beginnings as a species. Woven tightly into the fabric of life, the threads are usually invisible unless one is snagged. Then, for a moment, its individual course can be traced, exposing a fragment of the complex pattern of our evolutionary development.

It seems we each harbor a hidden self that reacts without thinking to signals embedded within our bodies and in the outside world. Every subconscious response reveals threads that comprise the fabric of our lives, a protective cloak that has been woven about us for millennia to ensure our survival. Today, in a world largely shaped by intellect, those ancient intuitive threads are frequently pulled. We must learn to read them, for they provide insights into our basic humanity.

Our ties to the green world are often subtle and unexpected. It is not merely that hemoglobin and chlorophyll bear a striking similarity in structure, or that plants provide the pleasure of food and flowers. When people who garden find new friendships with neighbors, when a walk in the woods brings relief from pent-up tensions, or when a potted begonia restores vitality to a geriatric patient, we can begin to sense the power of these connections and their importance to physical and psychological well-being.

I was bonded with plants at an early age. As a small, curious boy, I once watched my grandmother crush a dried zinnia flower in her hand, then gently blow on the mixed pile of fragments. Petals and other chaff flew off, leaving tiny brown daggers on her palm. "Seeds to grow next year," she said. It seemed incredible that from these dead shards could bloom flowers for the coming summer. How did she know? Surely this was a kind of ancient wisdom, a secret my grandmother had learned in the old country and which she was now passing on to me. I was awed and excited by the chance to practice this magic, and, with her guidance, soon started my own tiny garden.

My family lived in Baltimore in a house with three upstairs bedrooms. To make additional sleeping space for their five children, my parents enclosed a portion of the downstairs porch with windows, which, because I was the eldest boy, became my bedroom. As an eight-year-old, feeling banished in that remote part of the house, I was terrorized each night by an assortment of imagined intruders threatening to enter my windowed room. Only when the sky began to brighten in the East would I finally relax and fall into a deep sleep.

Every morning, before climbing upstairs to rejoin the family, I would walk into the backyard in slippers and robe to visit my plants, noting any new leaves or buds that might have emerged overnight. They were my secret friends, "Charlie's babies," and I wanted reassurance that all was well with them. This early communion was deeply comforting, chasing away nocturnal fears and renewing my spirit at the beginning of each day. Only many years later did I realize how tightly the ritual had bonded my view of plants to my feelings about them.

This particular way of seeing made me aware of the benefits of people-plant interactions in a wide range of settings—hospitals, geriatric centers, drug rehabilitation institutions, and prisons. Such benefits are evidenced in the behavior of city-dwellers who seek relief from urban stress by frequenting parks or fleeing to weekend retreats in the country. Contact with green nature is essential to well-being and offers peace and assurance.

Why should this be true?

Since the 1960s I have been trying to discover answers to that question... As we garden, tramp through field or forest, stroll in city parks, or rest beneath a tree, we may come to an unexpected door that opens inward to self. What begins as recreation can lead to profound investigation of the questions of human existence.

There are deep reasons for our love affair with nature. We are creatures who evolved in an environment already green. Within our cells live memories of the role vegetation played in fostering our survival as a species. Plants reconnect that distant past, calling forth feelings of tranquility and harmony, restoring mental and physical health in a contemporary, technological world. Whether in pots, gardens, fields, or forests, living plants remind us of that ancient connection.

Garden Beginnings

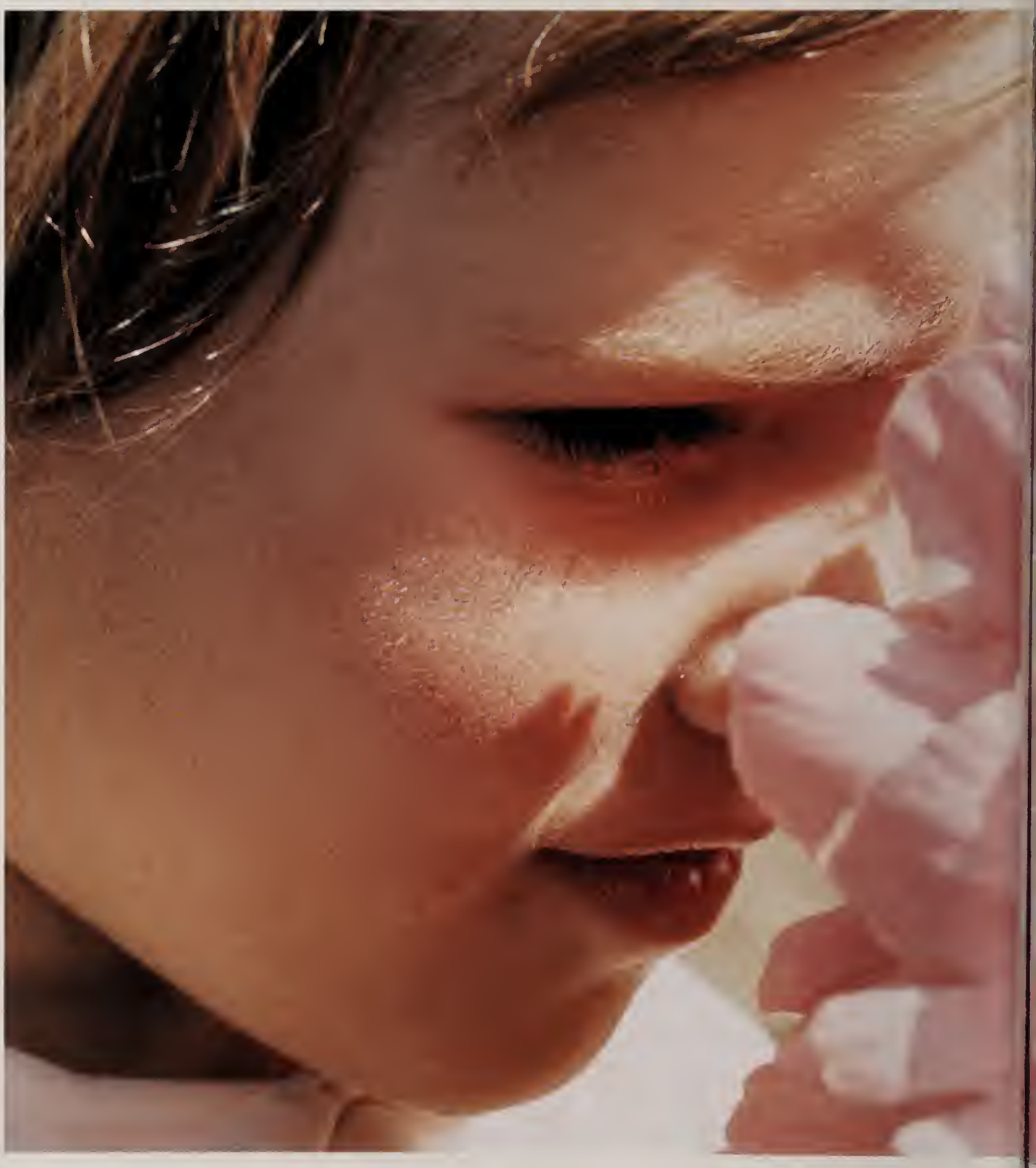
It was the sweetest, most mysterious-looking place any one could imagine.

Frances Hodgson Burnett; **The Secret Garden**

Gardening with Children

by Judy Allen

Judy Allen gardens and teaches near Wilson, Wyo. She is managing editor of Rocky Mountain Gardener magazine. *[Copyright © 1996 by Judy Allen. "Gardening with Children" originally appeared in* Rocky Mountain Gardener, *summer 1995 v.53, p. 18]*



Gardening is a sensory experience for children. Photo: Denver Botanic Gardens

My six-year-old friends and I have been "grazing" in our garden, moving from bed to bed and sampling each. As I turned my back, one youngster leaned over and whispered in shocked tones to the other, "Did you try this spinach? It's good!" His buddy nodded enthusiastically. These kids were experiencing spinach and gardening for the first time, hand-in-hand. In backyards, neighborhood plots and school gardens everywhere, kids and gardens are demonstrating a natural affinity, as productive and delightful as bees and honey.

As a gardening teacher and horticultural therapist for the past 17 years, I've watched hundreds of children thrive and grow in the garden. Most kids love playing in the soil. As sprouts themselves, they have concern and compassion for the tiny living plants in their gardens. They're fascinated by other life forms, too, including the worms and bugs most adults barely discern in what looks to us like a lifeless dirt patch. Best of all, kids love to grow food. The most modest yield is a robust quantity to their young bodies. In a world where being small is so often a liability, they find power and competence in handling tools and planting. As eight-year-old Stephan told me soberly, "I can help my family by growing this food."

At harvest time, children readily embrace crops they'd reject outright at the grocery store or on the dinner plate. It seems they're more willing to try vegetables they've had ownership in producing. Even bored pre-teens grin at the buried treasure of a bumper potato harvest. Broccoli, with its impressive green buds, is another favorite. Young children love the bright colors of radishes and carrots. Growing "salad" is more fun when it's seeded as cutting lettuce, and harvesting means a haircut with scissors. Tall or big crops, like sunflowers, corn or pumpkins, are awe-inspiring. Don't expect snap peas, raspberries or strawberries to make it inside the house. Even huge, overgrown zucchini become great "zucchini phones" or prompt a game of zucchini football!

To create a children's garden, approach it from a child's perspective. If you're a gardening addict, give your child his own patch so that you can work to your heart's content without encroaching on his space. Groups of children can work as

Photo: Denver Botanic Gardens.

partners in a small area. Raised beds have natural boundaries a child can respect: it's quite clear where the path ends and the garden begins. But a child's garden is theirs, where you're the visitor and sometimes advisor. Accept that the results may not look like your idea of a perfectly-tended plot.

Children can handle chaos, but they need success. Offer choices of both long and short term crops, so that they'll have radishes, lettuce and spinach to harvest while they're waiting for slower-maturing potatoes or pumpkins. Seed rows don't need to be planted straight, but seeds planted too deeply won't emerge. Five-year-old Megan carefully poked each pea seed in the ground the required depth, then playfully smeared the soil with both hands like fingerpaint. Her peas still grew right on schedule. Teach children to water gently to avoid dislodging seeds. Try using a row cover over newly-planted areas to compensate for some well-meaning lack of control.

If you live in a short-season area, be sure to know which crops are frost-sensitive. One mom planted a bean teepee for her daughters, only to find the vines frost-killed before they could climb the poles of the structure. Her girls were chagrined. In their mountain valley garden, peas would have been a better choice. Another fun activity is to scratch a name on the shell of an immature pumpkin. If you live where pumpkins don't survive, try using a zucchini instead.

Children have little patience for the more onerous gardening chores, like weeding or thinning (and who can blame them?). This is the time to lend a hand and work side-by-side. Point out the difference between plants and weeds, so that young eyes can make difficult distinctions between shapes and shades of green. Explain the grim necessity of thinning, and eat what you thin. Never require young children to work in the garden. They will perceive it as punishment, and it will color their joy for gardening permanently.

Above all, when you enter the garden with children, leave your adult concepts of space and time behind. Avoid adultisms like "hurry up." To a child, a small patch of ground can be a whole world of wonder. On hands and knees, my students and I once watched a spider carry its egg sack the entire length of a vegetable bed. At planting time, a young gardener was startled to see the broccoli transplants. "Wow, they're growing already!" he said with amazement. Often my students and I will just stroll the garden to "look and see what's different."

As a child the same age as my students, my first gardening experience was in a tiny backyard patch, where my mother and I planted easy crops. In my dim memories, our time in the garden was peaceful and relaxed. I suspect she liked working the ground as much as I did, and she was at her best helping me do simple tasks without criticism or judgment. I still remember feeling proud when my father crowed over my first radishes, the ones we'd carefully picked and chilled in ice water. As the next generation careens toward the 21st century, our gardens may be essential places, where we take time to share in the natural world that's the garden's gift to us and our children.

Plants for Young Gardeners

by Ken Slump, Denver Botanic Gardens Plant Records Manager

Following is a short selection of plants that children love to grow. Most are easy to care for and have fun, interesting features that enthrall young minds.

• Hollyhock (*Alcea rosea*)—A long popular garden plant that still delights. The seed pods are shaped like small wheels of cheese.

• Snapdragon (*Antirrhinum majus*)—Who can resist pinching the "jaws" to see them open wide? Be sure to plant the old fashioned type rather than the "butterfly" hybrids that lack jaws.

• Cockscomb (*Celosia cristata*)—Colorful annuals that may be dried. The crested types are probably more interesting to children than the plumosa form.

• Pumpkin (*Cucurbita maxima*)—The vine's rapid growth rate and captivating orange fruit should be able to hold the attention of even the most jaded young gardener.

• Carrot (*Daucus carota* ssp. *sativus*)—It's always a marvel to pull these orange, tasty roots out of the ground.

• Sunflower (*Helianthus annuus*)—A children's favorite. Easy to grow and has edible seeds, too.

• Strawflower (*Helichrysum bracteatum*)—Kids enjoy touching the curiously dry blossoms.

• Morning glory (*Ipomoea tricolor*)—Interesting for its intense blue color, rapid growth and predictable, yet fleeting flowers.

• Money plant (*Lunaria annua*)—The silvery, round pods may be rubbed to a metallic luster.

• Sensitive plant (*Mimosa pudica*)—Grow as a summer annual or houseplant. The leaves collapse and fold dramatically when touched.

• Four-o'clock (*Mirabilis jalapa*)—Easily grown from seed, the colorful, fragrant flowers don't open until late afternoon.

• Basil (*Ocimum basilicum*)—Extraordinary flavor from a very ordinary looking leaf. The purple-leaved varieties are ornamental.

• Radish (*Raphanus sativus*)—An interesting, colorful and fast-growing vegetable.

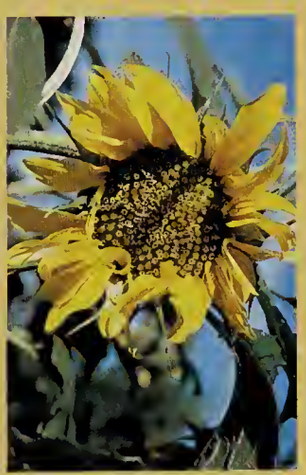
• Burro's tail sedum (*Sedum morganianum*)—A silvery succulent with a captivating name suitable for indoor culture at a sunny window.

• Lamb's ears (*Stachys byzantina*)—Dense silver hairs make the leaves of this perennial velvety to the touch and provide the common name.

• Marigold (*Tagetes* spp.)—Colorful and pungent, it's a great plant to illustrate the formation of seeds to save and grow another year.

• Corn (*Zea mays*)—A fascinating crop from start to finish. Kids enjoy growing popcorn and ornamental corn, too.

Pumpkin (*Cucurbita maxima*) Phota. Denver Botonic Gardens



Sunflower (*Helianthus annuus*)
Phata: Wendy Tucciarane

Lamb's ears (*Stachys byzontina*)
Phata: Mass Cremer

Gardening for Therapy

One of the most delightful things about a garden is the anticipation it provides.

W.E. Johns; The Passing Show

Horticultural Therapy: Gardens, Growth and People

by Rebecca Haller

Rebecca Haller, HTM, a lifelong gardener, manages the horticultural therapy program at Denver Botanic Gardens. She earned a master's degree in horticultural therapy from Kansas State University and has been an active leader of the American Horticultural Therapy Association for more than 10 years.

Think back to the first time you noticed the wonders of the plant world. How did you feel? What caught your attention? Was it that seed sprouting in a cup in elementary school? Was it the pile of leaves you enthusiastically jumped into as a child? Or was it the colorful wildflower meadow you saw on a mountain hike? I remember the tree house my sister and I enjoyed in a large mulberry tree and the summer days of climbing up, eating the ripe fruit that stained our hands and bare feet. Then, of course, there was the garden—the smell and feel of freshly turned earth at potato harvest time, the endless rows of green beans, the strawberries! How fortunate to have parents and grandparents who were gardeners.

The nurturing and enjoyment of plants can be a lifelong pursuit. From childhood to the golden years virtually everyone can find some pleasure here. Whether it be caring for a potted plant on a windowsill, savoring your homegrown tomatoes or planning and planting a water-smart perennial border, the possibilities are wide and varied.

Perhaps it is this characteristic of "something for everyone" as well as our agrarian roots that account for the fact that gardening continues to be the number one leisure activity in the United States. Perhaps, also, it is something deeper. Plants are essential for life! We are strongly biologically and psychologically connected to them. Most of you already know this on a personal level. Think about your own experiences.

I love to watch the seasons change in my outdoor garden. In the fall, I watch for the autumn crocus to appear as the nights get cool and the symphony of colored foliage begins. In the winter, I notice the beautiful bare structure of the tree branches and turn the compost pile when a warm day interrupts the cold. In spring, the bulbs appear, the perennials peek through the soil, the eagerness of planting begins! And in summer, of course there are the pleasures of harvest, of shared evenings on the patio perfumed by night-scented stock, of lush growth and bare feet. All of this feeds me deeply.

As we care for our gardens, they, in turn, care for us. This we know. In horticultural therapy, we make the most of this relationship. For example, if you are working to regain the strength in your arm following an injury, it would be much more interesting to do your exercises in a garden than in a hospital room. While working in the garden (in an environment so unlike the rest of the hospital), you can focus on its beauty and on a feeling of being well.

If someone you know is in a nursing home, a garden may entice her to get outside, to socialize, to do something productive. Studies have shown that nursing home residents who garden are more satisfied with their lives. Tending to the needs of a plant can open up a new world to a child from a tough neighborhood. With the guidance of a horticultural therapist he may learn about his own needs in order to thrive by learning about the plant's needs, or he may discover a future career in a greenhouse or landscaping.

Horticultural therapists know how to use gardening activities to help people regain health, learn work skills or stay active as they age. They also are trained to be able to create accessible gardens to enable those with disabilities, illnesses or injuries to grow something. In these gardens they may use raised beds, tools to fit the needs of the gardener and smooth pathways that are easy to access. They work in rehabilitation hospitals, mental health centers, prisons, nursing homes, hospices, vocational training programs, schools and many other settings. As part of a team, they cooperate with counselors, physical therapists, occupational therapists and other health care and human service professionals to help others.

Denver Botanic Gardens' horticultural therapy program focuses on training these therapists. Students generally seek to build upon previous experience in horticulture or human service.

Here they learn about plants. For instance, they can learn about those that are non-toxic and thus, safe to use in their programs, those that appeal to children, those that are easy to multiply by cuttings or how to preserve plant materials for winter use.

They learn special techniques. Training methods are taught to enable someone who is developmentally disabled to pot up a hanging basket or perform other tasks in a greenhouse. Students practice propagating houseplants using only one hand or weeding a raised bed garden from a wheelchair.

They gain skills. We teach how to use garden-related activities to meet specific treatment goals. For example, gardening can be used to help a person recovering from drug addiction to begin caring for himself. Or, a woman who has had a stroke could be encouraged to walk again in a well-designed garden setting. Students learn how to apply the use of horticulture for a wide variety of human needs.

They earn credit. Classes can be taken for Continuing Education Units in order to advance the student toward professional registration by the American Horticultural Therapy Association. This can be an important step for employment or to maintain certification in a related profession. College internships offered each year give hands-on experience with a variety of groups. An intern might, for instance, spend the morning teaching special education students to water the greenhouse and the afternoon helping people with mental illness to plant beans in their community garden plot. In both examples, he or she works closely with other human service staff to help these people be more independent and accepted in the community.

They meet others with similar interests. DBG's horticultural therapy program is a clearinghouse for information, networking and learning in the Rocky Mountain region and beyond.

The Morrison Horticultural Demonstration Center, at 11th Avenue and York Street in Denver,

is the hub for this activity. At the Morrison Center students and the public can see a fully accessible facility in operation, including raised beds, accessible pathways, the sensory garden and an indoor classroom and greenhouse. Here they can observe and practice skills learned in classes and gain inspiration for their own gardens.

Let's take a visit to the Morrison Center on a day in late spring. We might see a group from a local nursing home enjoying the smells and tastes of the sensory garden. They are led by a volunteer guide who shares his delight over the chocolate mint plant. It is the first time this spring that they have been out, and it feels good to explore the garden with such close individual attention.

We may be asked to pitch in to help a young apprentice from an area vocational technical school plant the last of the scented geraniums in a raised bed. He knows what he is doing and works hard with great pride. He also happens to be developmentally disabled.

Students receive hands-on training form Denver Botanic Gardens' horticultural therapy staff. Photo: Moss Cremer.

We may see a group of children who are blind explore the water garden. They can't keep their hands out of it. The furry lamb's ears also are irresistible.

We may come across an experienced community gardener giving help or tips to the folks planting beans that we talked about earlier. Through this common interest barriers to understanding are broken down. The people who have a mental illness practice being with others out in the community, and the helpful community gardener becomes less afraid of them.

In the Morrison Center classroom, public school teachers are learning how to better address the needs of their special education students through the use of plants. They get detailed instruction on how to help children with special needs be successful at growing plants in the classroom, helping them become more effective teachers.

Meanwhile, the horticultural therapy staff are preparing to present an upcoming symposium on raised bed gardening, answering calls for advice or information on horticultural therapy and sending a sensory garden plant list off to a designer in Louisiana. All of these activities are centered around one purpose: to encourage the use of horticultural therapy to help people improve their lives.

Over the course of my career, I have personally seen people grow toward their potential time and time again through the use of horticultural therapy. It can be a powerful tool. For children and seniors and those in between, gardening can be a source of relaxation, of contemplation, of exercise, of stress reduction, of food, of beauty, of pride. For me, it provides all of these. It also has grown into my profession. What more can you ask for than to have a life of growing turn into a way to help others grow?

So now that you know something about how much gardening can give back, do yourself a favor and plant a garden. Do someone else a favor and help them to do the same.

Gardening for Health

by Christine Kramer

Christine Kramer is a journalist and former reporter for Denver Catholic Register. *She continues to write freelance articles and has won several regional awards for feature writing. Currently she is a horticultural therapy assistant at Denver Botanic Gardens, where she has worked for five years.*

Lainie Jackson in Denver Botanic Gardens' community gardens. Photo: Wendy Tucciarone.

No matter how long the winter, how deep the snow or how hard the frost, nature always triumphs. No season is awaited so eagerly or welcomed so warmly as spring. Hope is experienced by most gardeners, a fact that is encouraged by horticultural therapists who use gardens in human services.

For Lainie Jackson, long-time Denver Botanic Gardens volunteer, it was the hope of spring that helped her deal with the threat of cancer five years ago.

"I was diagnosed with breast cancer in the winter, and by next spring I was back gardening," she explained.

Lainie grew up with dirt on her fingers and a love for all things that grow. It was this love of gardening, she says, that helped her deal with cancer.

"I remember how my family loved gardening, especially growing iris. They would have a garden party every spring and I would fix a huge bowl of iris to bring indoors," she said.

Another vivid memory she recalls is picking bunches of violets after school for her mother. Many years later Lainie often took her ailing mother flowers from her own cutting garden.

Lainie has been involved with Denver Botanic Gardens for 34 years in many capacities, including past president and current honorary volunteer chairman of the Denver Botanic Gardens Guild. In addition to her volunteer work at the Gardens she has spent the last five years tending a flower garden at QuaLife Wellness Community in a program that enriches the quality of life for people dealing with cancer.

"Gardening has been very healing for Lainie. It's been a part of her for a very long time," said Dr. Paul Hamilton, friend of Lainie and co-founder of QuaLife.

Soon after Lainie started volunteering at QuaLife she was diagnosed with cancer.

"Members of my family have been diagnosed with breast cancer, so it was something I always watched for," she said. "But you never expect it, and it came as a surprise. Once I found out, my goal was to get physically well enough to garden again."

According to Dr. Hamilton, the mission at QuaLife is to enrich the quality of life of people confronting cancer or other life-challenging illnesses, and to empower people to take control of their lives and decisions they need to make regarding their illness.

Some of the ways this is accomplished, he explained, are through ongoing support groups and wellness weekends. These three-day experiences offer participants the time to explore issues around health beliefs, attitudes, lifestyles and relationships. Some topics include relaxation techniques, journal writing, music and art, nutrition and family communication.

At QuaLife a separate plant-filled room is used for relaxation—a place where people can feel "well." The plant room was designed by Melinda Campbell, daughter of DBG's trustee Dr. William Campbell.

"It's a wonderful room and it's so conducive to healing," said Dr. Hamilton.

QuaLife hopes to add to the existing plant room a more structured horticultural therapy program that relies on hands-on contact with plants.

"Horticultural therapy has tremendous potential," Hamilton said. He believes it would be very beneficial to have a trained horticultural therapist and an area in any hospital setting where the horticultural therapist could work with the patients allowing them to experience such healing techniques as potting plants and tending flowers.

"Many complementary therapies, such as horticultural therapy and those offered at QuaLife, are having a great impact on cancer patients' lives,"said Hamilton.

He cited a study by the Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, which examined two groups of women with breast cancer. Both groups underwent traditional therapy such as radiation and chemotherapy, but one group also was organized into a support group. They learned how to control anxiety and were taught skills in controlling pain.

The study found that the women who learned other coping skills and attended support groups lived twice as long as the women who received traditional therapy only. These and other studies show that psychotherapy and other forms of psychosocial support are effective psychologically, and in some instances, possibly physically.

These types of support groups are similar to the experience of working with a horticultural therapist, explained Rebecca Haller, horticultural therapist at Denver Botanic Gardens. "The horticultural therapist takes the support group concept and centers it around plants, capitalizing on both the popularity of gardening and the nurturing environment of plants," she said.

This type of experience is no revelation to Jackson, who has lived a life full of gardening and enjoys the healing powers of nature.

"My advice to people who are suffering from an illness is to do anything you like outside with nature," she said. "Take things in small measures—a little bit at a time."

In the summer of 1996, Dr. Paul Hamilton died. During his life, he made many significant contributions to the holistic treatment of people suffering from illness. —Ed.

Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens

Perennials — A Retrospective
The best of The Green Thumb magazine
Mountain, Plain and Garden
The Magazine of Denver Botanic Gardens • Volume 13 No.1 • Spring 1996

Sold at Denver Botanic Gardens' Gift Shop, 1005 York St., and at full-service nurseries and garden centers along the Front Range.

Next Issue: **Water Gardening**
Inquiries: 303-370-8033.

Realm of the Senses

by Kathleen McCormick

Kathleen McCormick is a writer and editor with 20 years experience in journalism. She has written on horticulture, design and the environment for such publications as The New York Times *and* Preservation, Landscape Architecture *and* Better Homes and Gardens *magazines. As a partner in Fountainhead Communications, she has worked with public agencies and private design firms and has conducted writing seminars for landscape architects and other designers. Recently she earned her certification as a master gardener. "Realm of the Senses" first appeared in* Landscape Architecture *magazine, January 1995, v. 85, no. 1.*

An overview of the Joel Schnaper Memorial Garden. Photo: Sara Cedar Miller.

On a 3,000 square-foot Manhattan rooftop terrace, the Joel Schnaper Memorial Garden is causing a quiet revolution in restorative care for AIDS patients. Patients, families and staff gather to visit, recreate, celebrate and meditate in this garden filled with fragrant plants and magical sounds, located at the Terrence Cardinal Cooke Health Care Center's residential AIDS unit.

"It ain't a pretty garden—it's a garden for people," says landscape architect David Kamp, principal of Dirtworks in New York City. His

Joel Schnaper Memorial Gorden. Photo: Soro Cedor Miller.

main objective was to give people acutely ill with AIDS the chance "to experience a sense of nurturing and connection with nature."

The idea began to evolve three years ago, when the hospital covered the rooftop with terra cotta pavers to make a terrace. Administrators contacted the Tamarind Foundation, a New York-based nonprofit organization that has sponsored gardens for people with AIDS. Some months later, Kamp approached Tamarind with his notion of creating a healing garden for AIDS patients. The match was made.

Begun in March 1993, the garden was built entirely with volunteer help and $55,000 in donations raised primarily by Harry Schnaper, an interior designer in New York, in honor of his brother Joel, a San Francisco landscape architect who died of AIDS. The donations paid for benches, therapy tables, a contractor and a small endowment for maintenance. Plants, hardscape materials, artwork and labor, including Kamp's own design and supervisory services, were given gratis. Volunteers ranged from the city's Green Guerrillas and schoolchildren to New York Cares, a group of young professionals.

From the start, Kamp aimed to stimulate the senses. As sources for design ideas, he talked with physicians and therapists who specialize in horticulture, recreation and physical rehabilitation. They identified time as a critical element.

Because most patients are so ill, they "needed a 'quick fix'—like shaking a rosemary bush," says Kamp. So he designed with immediate and constant sensory stimulation in mind, focusing especially on sound and fragrance. These are common denominators for the many patients who are blind, have lost taste or find touch painful.

To keep patients who suffer from dementia from getting lost from one end of the garden to the other, Kamp created a spoke-like design with simple circulation patterns, open views and a central planter of bright marigolds. A path of leaves painted on the pavers leads from the entry to a series of garden rooms defined by lattice screens, tent pavilions and vine-covered trellises, which also provide shade for patients who are extremely sensitive to the sun.

Working with artists Bill and Mary Buchen of Sonic Architecture, Kamp included various sounds to help orient patients and to mask the drone of generators and rooftop air-conditioning units. Entering the garden, patients hear the bright, metallic sounds of stereophonic wind chimes. At the far end, a fountain and bone-like wooden chimes create more meditative tones. Fragrances also help orient patients, from a wisteria-covered pergola near the entrance to the "farm area" where planters are filled with herbs, flowers and dwarf apple trees.

Texture was important, both in the variety of plants and in constructed surfaces. The tight-grained cedar used for columns, trellises and planters was sanded several times to avoid splinters. Because some patients would not feel well enough to come out onto the terrace, Kamp tried to make the design visually interesting. Elements like buddleia, which attracts butterflies, and a kinetic wind sculpture, "Lucky Bird in Circles," designed by California artist Susan Beran, can now be appreciated from the adjacent day room and dining room, as well as from patients' rooms overlooking the garden.

Beyond the realm of senses, the garden had to function on a practical level. When Kamp began designing the project, a heavy metal door with a short, steep upramp led to the terrace from the day room. He specified an automatic door and a longer ramp of no more than five degrees' inclination. Now wheelchair-bound patients can enter the garden under their own power.

Once out there, they need plenty of space to move around and accessibility to perform simple gardening tasks that are part of their therapeutic work. So the passages are wide, work tables are adjustable and planters vary in height and shape (some are round) with wide railings for resting tools and materials. The heaviest elements, two honeylocust trees, are "planted" over the building's structural columns. Large planters, some of them plastic terra cotta, are located directly over the building's beams. To reduce weight, Styrofoam "peanuts" were used instead of gravel at the base of the planters, along with a light-weight soil mix. A water source for the drip irrigation system was created by punching through the brick walls to plumbing for the upper floors rising next to the terrace.

"A lot of the design was finessed by the patients themselves," says Kamp. "Patients would ask, 'Where is north?' So we painted a compass," using the same green-black paint that creates a rug-like effect separating the "rooms."

One of the most exciting aspects of the garden "is bringing nature up to the sixth floor in New York City—it's very special to have bees and butterflies up there," says Nancy Chambers, an advisor for the garden and director of the horticultural therapy program at the Rusk Institute of New York University Medical Center. Chambers considers it an AIDS-care model.

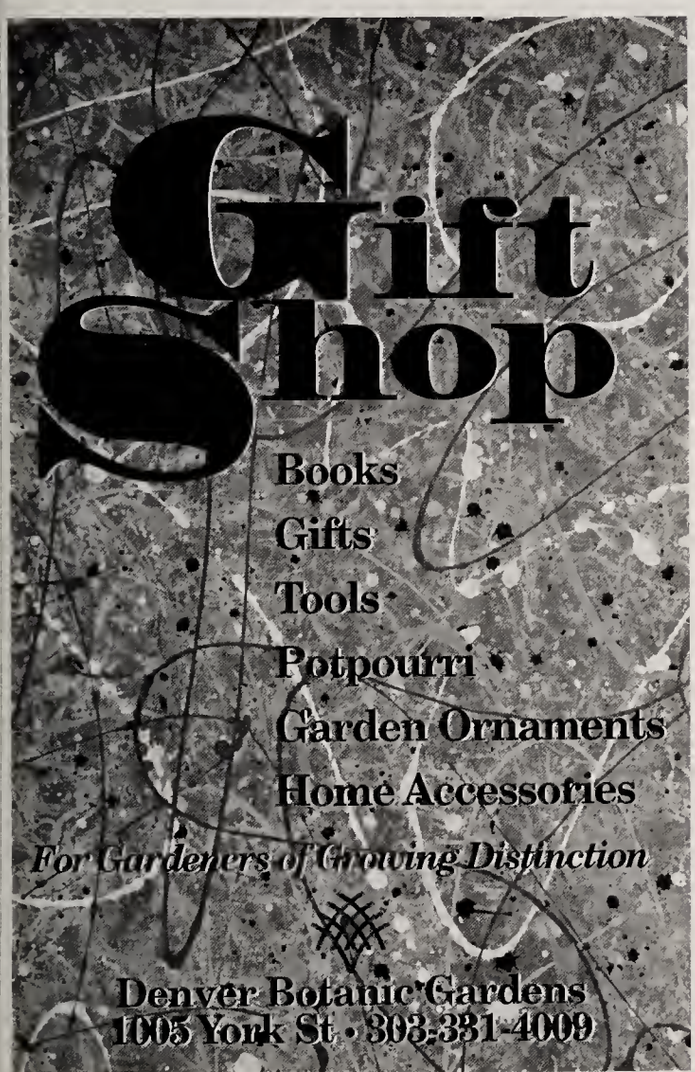
"The garden has been received fantastically," says Peter Karow, the hospital's vice president for operations and nursing facility administrator, though he can point to no specific scientific results attesting to its restorative powers. "It's been a morale booster for both patients and staff," he continues, "to see this raw rooftop turned into a lush green area... we see it having lots of therapeutic possibilities."

As a place for activities ranging from Calypso Night parties to exercise classes, the garden "has provided much more of sense of community than we're otherwise able to provide," says Mimi Fierle, director of therapeutic recreation. Many of the patients "never had access to anything this beautiful," she notes, and nurturing this garden has increased their sense of self-esteem and well-being.

What has made the greatest impact, adds Fierle, is that "people have the chance to see the ebb and flow of nature, and that has a very calming effect."

At Denver Botanic Gardens people with AIDS reap the benefits—both produce and peace-of-mind—of gardening in the community gardens. For years the Colorado AIDS Project (CAP) has offered its participants a chance to work in several garden plots.

Many other gardens also are utilized by therapists and patients in hospitals throughout the region. Craig Rehabilitation Hospital in Denver is an exemplary one, where patients with head or spinal cord injuries can garden for physical and mental therapy. —Ed.



Prison Propagation

by David Hackenberry

David Hackenberry is a registered horticultural therapist teaching vocational horticulture for the Colorado Department of Corrections. David was a Denver Botanic Gardens horticultural therapy intern while completing his bachelor of science degree from Kansas State University.

As a student intern in Horticultural Therapy at Denver Botanic Gardens during the spring and summer of 1985, I worked with a wide variety of people; developmentally disabled, chronically mentally ill, Asian immigrants and school students. It was heartening to see how gardening can be incorporated into the lives of all people, regardless of their ability.

For the past seven years I have been using horticulture as therapy with a population I never imagined working with while doing my internship. I am a vocational horticulture instructor for the Colorado Department of Corrections currently working at the San Carlos Correctional Facility and the Pueblo Minimum Center, and I see many examples of gardening having positive effects on the men and women who are incarcerated.

The vocational training program I run is modeled after a real job in the work place, and as such, each inmate is evaluated on basic attributes of a good worker. In the greenhouse and landscaping setting we form work habits, proper response to supervision, quantity and quality of work, care and safety.

The theory of work-as-therapy suggests that a person who is busy doing physical labor has less time for self pity and little energy to engage in unhealthy activities. Die-hard gardeners that go along with horticulture know that the moderate exercise, fresh air and sunshine provides stress reduction and almost always a good night's sleep. The work in the garden is intrinsically therapeutic.

Classroom work that goes along with on-the-job training also insists that the inmates work to develop good study habits. It challenges them to expand their knowledge through the use of scientific inquiry in the greenhouse laboratory. Memory and memorization techniques are improved through plant identification including common and Latin names of a wide range of plants.

With few exceptions, the inmates at the San Carlos Correctional Facility, a facility designed to work with the mentally ill offender, and the female inmates housed at the Pueblo Minimum Center, will be returning to communities throughout Colorado. It is challenging to help them develop into good gardeners who will in turn be productive citizens.

After showing a class a book on cacti and succulents I had an inmate follow me down the hall to ask if he could borrow the book to read it more in-depth until the next class. A female offender student who had been landscaping proudly said she needed to request a smaller uniform because she lost weight on the job. I gave a group of inmates a work break—only to see them pull out their stack of flash cards to quiz each other on Latin names of perennials. After instances like these I know gardening will make these people more manageable in prison and more stable citizens once released.

Ruthless Perfection

by Shane Smith

Shane Smith is director of the Cheyenne Botanic Gardens and author of The Greenhouse Gardener's Companion *and* Rocky Mountain Garden Calendar *published by Fulcrum. [Copyright © 1996 by Shane Smith.]*

Illustration: Joe Gomez.

Aren't we gardeners a special breed? We have a special kind of patience waiting for a flower to bloom. We think nothing of waiting three years in order to see the full potential of a particular perennial. We even plant trees that won't mature until we are buried in the ground. We possess a special kind of optimism that we will have a harvest without hail, insects or disease infestations. We have a special appreciation of beauty. When things do go wrong for gardeners we become stoic, taking bad luck in stride, dust ourselves off and learn from the experience.

There is, however, one defect that many gardeners share. We're too kind! So kind, that most of the common afflictions of the yard and garden can be directly attributed to an overabundance of kindness. This kindness, the worst disease of the garden, is common to some degree in even the most experienced of gardeners. Why do I know this? It takes one to know one. Let's look closer at some specific examples of this affliction.

Oh how we want to have the earliest and biggest tomatoes on the block. So instead of the average dose of manure or fertilizer, we put twice as much on for twice as much yield, right? Wrong! Excess nitrogen on tomatoes means you get a gigantic beautiful dark green plant but fewer fruits. Kindness to your plants equals no tomatoes.

We want to have a lawn that is not being strangled by an ever-increasing population of dandelions. So when we start mixing up the dandelion herbicide and it says "one teaspoon," we think we'll really do our lawn a favor by doubling the dosage. This will really make our lawn look good, right? Wrong! When you over-apply dandelion herbicide you end up burning the top of the weed before the chemical ever moves down into the root. Then the dandelion re-sprouts from the root in just a matter of weeks.

Garden plants on the Front Range often are deficient in iron due to the soil pH. This is marked by a yellowing of the new leaves while the veins often remain green. All it takes is a little iron fertilizer. Overdo iron fertilizing (as most people do) and you severely burn the leaves and end up triggering more severe deficiencies of other nutrients.

New gardeners can't bear to thin carrots. Why? Because this means pulling up perfectly good plants to make room for the rest. You can almost hear the little carrot seedlings screaming for mercy as the roots are ripped from the soil. So if you're too kind and don't thin, the result is little or no harvest.

When I was a child I remember when my mother was in an unusually ruthless mood. She just plain got tired of a *Sansevieria* (mother-in-law's tongue). She calmly set the poor little house plant outside on a frigid winter day. I remember looking at this helpless plant freezing to death outside on our back step. "Why did you do that, mom?" I asked. "Because I was just tired of that plant." When most people tire of a plant they either continue to tolerate it or better yet, give it away to another kind-hearted person. Eventually these kind-hearted people end up with a house full of mediocre houseplants that they really don't care a hoot about. Houseplants that have your full love and affection often succumb to your overabundance of water and fertilizer.

When I decide to dispose of a houseplant, I use the tried and true "hostage method." When a friend stops by the house, I tell them, "If you don't take this plant home, I'm throwing it in the trash today." They can't resist ending this hostage situation and invariably take it home.

The same happens to people in their landscape. A few years back I was on a book signing tour and was invited to talk about gardening on a radio show back East. I brought up the subject of ruthless gardening and within minutes the telephone lines lit up. The first caller was asking my permission to allow him to pull out a forsythia in his yard. "I have hated that plant for years," he said. The guilt he felt could only be dealt with by getting the permission of a horticulturist. "Yes, caller, if you don't like the forsythia, rip it out!"

Next caller: "I have all these old daylilies and oriental poppies taking over my perennial border. Is it OK to just take them out?" "Yes," I replied, "pull them out and grow something you really want to grow."

Anyone can muster the courage to pull out a weed, but it takes a real gardener with ruthless perfection to pull up a tree, a perennial or toss out a houseplant. This is what really separates the green thumbs from the brown.

In a world where kindness is getting in short supply, gardeners of the world are hoarding gobs of the stuff. Too much kindness in gardening and you end up with plants you don't really care much about. The garden becomes a dreary,

guilt-ridden place. You become a victim of the plants for which you have little interest. The plants that you really love invariably end up getting damaged or die from your excessive kindness (usually too much fertilizer or water). In our passion for a plant, moderation disappears. We mistakenly think if a little is good, more must be better.

You'll be glad to know that psychologists have studied the problem of kindness among gardeners and have named it the "smother with love" syndrome or SWL "swell" syndrome for short. Some believe it to be caused by a virus. Others believe it comes from reading too many garden magazines and labels of Ortho garden chemicals. Perhaps it's all genetic. Whatever the cause, the cure is years away.

Fortunately there is hope for rehabilitation. Don't go sprouting your day to day problems to an $80 shrink. Instead, save your life's problems for your garden. It's infinitely easier to toss out a mediocre houseplant after a disagreement with your spouse. Dig up unwanted landscape plants on April 15, after mailing your tax returns. Thin your carrots after you pay the bills. Dig in the garden when you're grumpy or after your teenagers sport their first mohawk or pierced nose. Go easy with your love and kindness in the garden—it's dangerous stuff: Save it for the real world. I'm talking about some real therapy—instead of going to the shrink, go to the nursery and buy the most interesting and intriguing houseplants, perennials, shrubs or trees you can find. Grow what you want, where you want it! Get rid of everything else.

After all this therapy, you will feel an unusual calmness and a sense of master in the garden. You can then approach the art of gardening with complete focus and a clean slate. Select the perennials you really want to grow. Plant the trees and shrubs where you really want them, instead of putting up with what you've inherited. Stop being a victim to your garden... it's OK, I'm a horticulturist, I'm here to help and I give you permission to be ruthless in the garden.

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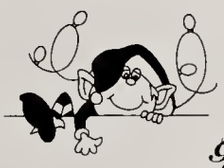

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Plants to Delight the Senses

by Ken Slump, Denver Botanic Gardens Plant Records Manager

Many plants not only stimulate sight, but also taste, smell, hearing and touch. These are especially suited for horticultural therapy programs. Following are some plants with bold colors, strong aromas, interesting textures or features that make noise.

• Maple (*Acer* spp.)–Probably the most beautiful and ornamental genus of deciduous trees for temperate climates. For fall color in Denver plant the large growing sugar maple (*A. saccharum*) or red maple (*A. rubrum*). Bigtooth maple (*A. grandidentatum*) is a somewhat smaller tree. A diminutive maple with good fall color is Amur maple (*A. ginnala*).

• Winged euonymus (*Euonymus alatus*)–A fascinating shrub during the dormant season for its corky "winged" twigs. Fall color is scarlet, and a popular dwarf variety is available.

• Shrub althaea (*Hibiscus syriacus*)–An adaptable, old-fashioned shrub that produces large, exotic flowers in late summer when few shrubs are blooming.

• Mint (*Mentha* spp.)–Valued for their essential oils, there are scents and flavors to surprise and delight every nose and palette.

• Japanese silver grass (*Miscanthus sinensis*)–Choose from numerous cultivars of this big ornamental grass whose dried foliage and ripened seed heads rustle musically in autumn breezes.

• Daffodil (*Narcissus* cvs.)–Lots of varieties. A showy and easy bulb to cultivate; delightful every spring. (Note: Bulbs are highly toxic if ingested.)

• Scented geranium (*Pelargonium* spp.)–Many curious types with aromatic foliage may be grown in Colorado as annuals. Choose from spicy, fruity or herbal scents.

• Moth orchid (*Phalaenopsis* cvs.)–If everyone knew of this beautiful tropical orchid's undemanding nature and long lasting flowers, there wouldn't be enough to go around.

• Nanking cherry (*Prunus tomentosa*)–A large, sturdy shrub with pale pink spring blossoms. Edible, small sour cherries are produced in early summer.

• Rose (*Rosa* spp.)–Perhaps the most symbolic and beloved flower. The incomparable blossoms on thorny stems can teach many lessons. Choose from endless types, hybrids and species–even thornless ones!

• Rosemary (*Rosmarinus officinalis*)–An attractive outdoor container herb with an unmistakable pungent aroma. The plant may be carried through the winter in a cool room near a sunny window.

• American linden (*Tilia americana*)–Is there a sweeter fragrance than that of a flowering linden tree on a warm late June evening?

DBG's Moy Bonfils Stonton Memoriol Rose Gorden. Photo: Denver Botonic Gordens

Doffodil (*Norcissus* cv.) with *Forsythio*
Photo: Denver Botonic Gordens

Rosemory (*Rosmorinus officinolis*)
Photo: Wendy Tucciorone

Gardening for the Golden Years

But though I am an old man, I am but a young gardener.

Thomas Jefferson; In a letter to Charles Wilson Peale, 20 August 1811

Gardens as a Thread Throughout Life

by Christine Kramer

Mox Schwartz in his community garden plot. Photo: Moss Cremer.

Gardening for Relaxation

At age 88 Max Schwartz knows how to bring a sense of peace into his life, even after a recent fall left him badly bruised. He says the answer lies in his garden.

"Why do I garden? It gives one a feeling of calm and I believe it has prolonged my life," says Schwartz as he walks along the worn paths of the Morrison Center Community Gardens at Denver Botanic Gardens.

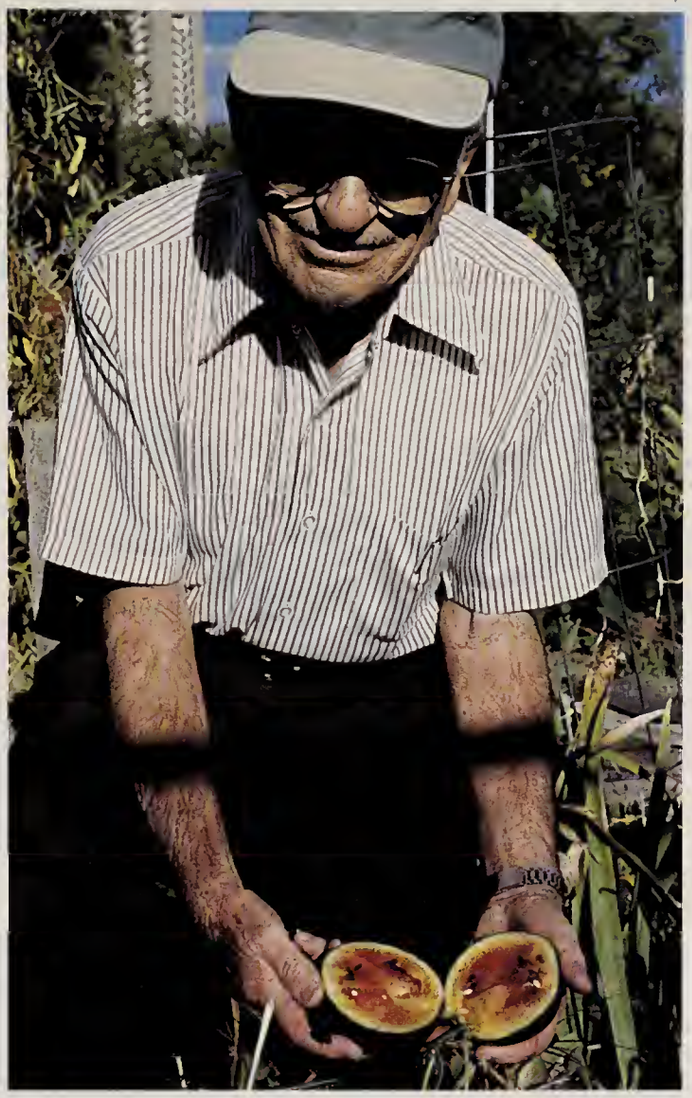
"It lowers your blood pressure and your stress level. Gardening is an escape from reality. It's like fishing. You throw your line in and wait. If you catch something, fine, and if not, fine too. It's just relaxing," he explains. "With gardening you can bury your mistakes. If something doesn't grow you just replant it."

Schwartz knows all about replanting failed crops and trying new ones. He has been gardening at Denver Botanic Gardens for 14 years. As he surveys the fruits of the closing season, including a try at baby watermelons, he explains that his love for the earth started long ago at age 10 in New York City. He wrote to the department of agriculture for free seeds and grew them in his backyard. "I always loved growing things," remembers the first generation gardener.

Even throughout his career as a dentist in New York he grew vegetables on his 10th floor balcony, but the bees wouldn't fly that high so he never had an abundance of crops. So when he and his wife moved to Denver he joined the community gardens, a system he says offers many pleasant moments of sharing food and comraderie.

"The produce you grow you can give to your neighbor and you can freeze it for later," he explains. "There is great joy in taking out corn from the freezer in December and recalling the past gardening season. All of this prolongs the period you have calm."

Even when the season is complete he finds joy in looking at seed catalogs that arrive when the snow is falling. He can look forward to the next season with hope and anticipation for new wonders.



Schwartz shows off the fruits of his harvest. Photo: Moss Cremer.

Schwartz says to achieve this sense of calm in the garden is something anyone can do, young or old. "If you lack the strength of youth there are many things you can do," he says. Using long-handled adaptive tools, pads for bending on knees and gardening in the early morning coolness are all ways he prolongs the time he can spend in his garden. Schwartz also prepares pockets for each plant and stakes the area so that he knows where he needs to water, similar to container gardening in a larger plot.

As a tribute to his love of gardening he and his daughter are collaborating on a cookbook. The theme is cooking by the month with fruits from the garden.

Learning from Gardening

Just as Schwartz has found the restorative powers of tending a garden, 75-year-old community gardener Ruth Davis loves digging in the soil.

"With gardening there's always something to look forward to. All you have to do is plant a seed and watch it grow," says Davis as she surveys her small but full plot in the Waring Community Garden at Denver Botanic Gardens. Her love for the garden began as a young child.

"As a little girl I used to walk to school during the depression years. My friends and I would walk by private homes and gardens and our conversation would always be about nature, the trees, birds and the gardens," she remembers.

As a high school geography teacher Davis remembers always trying to bring the idea of growing plants into the classroom. She would make cuttings at home and bring them in for the students, whom she said were some of the toughest kids from the slums. Yet, the plants touched them.

"The kids loved the plants. Years later I would see one working in a gas station and they would tell me the plant was now huge," she says. "Giving them a plant was a great experience. They learned there were green things on this earth."

Her love of the earth and gardening was enhanced when she moved to Denver six years ago and joined the community gardens. Her advice to all gardeners, including those who are aging, is to join a community garden.

"It's exciting to see things grow. Even in a small space you can grow little tomatoes, and then experience how exciting it is to pick something off a stem and pop it in your mouth.

"I will garden as long as I'm able because gardening is a great learning experience for people of all ages."

Ruth Davis tends to her community garden. Photo: Moss Cremer.

Tools for Lifelong Gardening

by Janet Laminack

Janet Laminack has a bachelor of science degree in horticulture from Texas A&M University with a study emphasis in social sciences. She is the horticultural therapy specialist at Denver Botanic Gardens.

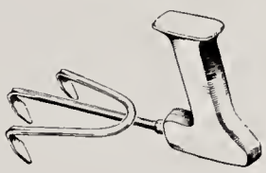
Gardening for life. Does that mean gardening is life-giving? Or is it more of a wake-up call to take care of ourselves so we will be able to enjoy gardening all our life?

Gardening is America's favorite outdoor leisure activity. Some people give up gardening as they become older, finding that they are less physically able than they once were. Denver Botanic Gardens' Horticultural Therapy program shows that gardening is for everyone. The key is to adapt gardening to one's own physical capabilities. There are many ways to accomplish this, such as using adaptive tools and raised bed garden structures.

One way to ensure gardening for life is to make it easier on your body. Use gardening tools that work with your body, not against it. The most important factor when finding the right tool is to consider what you need. It is very possible that you will not need to spend much money buying new tools. The trouble areas for most people while gardening are a limited ability to grasp, bending or mobility difficulty or diminishing strength and endurance.

Limited Ability to Grasp

With carpel tunnel syndrome and arthritis plaguing our nation, many people find they are not able to grasp or hold onto their gardening tools comfortably.



Fistgrip tools are ideal because they are designed so that the wrist is not bent. Not only is the grasp stronger, but strain is also taken off the wrist area.

Trigger grip tools are becoming a common sight in garden shops. The tools have a small trigger which allows a more secure grip.

A very simple and economic adaptation to a tool is a foam rubber grip. For this do-it-yourself adaptive tool, pipe insulation is wrapped around the grip of a hand tool. It provides a large, soft handle making the tool easier to hold, and it cushions the impact of gardening activities, such as digging.

Illustrations: Jack Kramer

Gardening with a kneeler. Photo: Janet Laminack

Bending or Mobility Difficulty

The back is perhaps the most abused part of the body, especially while gardening. But there are tools that can help you lift, stoop and reach.

To eliminate bending while gardening at ground level, try a long-handled diamond hoe. It has a very long handle that provides enough length so that cultivating can be done from a standing posture. The small diamond head makes it ideal for weeding among plants.

One-handed flower shears and long-handled flower gatherers and pruners are practically a must for rose gardeners. Both hold stems after cutting so that flowers do not drop to the ground. The long-handled pruner also furnishes length which allows for a longer reach, so you don't have to be in among the thorns.

The oscillating hoe eases back strain while cultivating from a standing position. It works by remaining on the soil surface removing weeds with a push-pull movement rather than the chop-chop of a hoe.

The handle-it back saver is another example of a simple adaptation to your existing tools. The extra handle can be added to shovels, rakes, hoes or even snow shovels. It keeps the body in a more upright posture while digging or cultivating and adds leverage so the entire weight of lifting is not put on your back.

Kneeling aids also can ease the strain of ground-level gardening. These range from knee pads to kneelers to garden scoots. Assess your needs to determine which kneeling aid best suits you.

Kneeling pads provide cushion while gardening at ground level. Similarly, knee pads that strap around your legs accomplish the same thing. Garden shops carry both, or some people prefer to purchase athletic knee pads from sporting goods stores.

Kneelers have handles that greatly aid in getting back to a standing position. They also flip to provide a portable seat. However, they often do not offer enough cushion to be comfortable while on the ground.

A garden scoot is mobile and has room for storage. It also takes the strain off the legs and knees since it is a seat rather than a kneeling device.

Diminishing Strength and Endurance

Most people would welcome an extra boost of strength and endurance while gardening. Proper utilization of tools does just that—puts the tool to work for you. Any tool that minimizes fatigue is maximizing endurance. A great example is the fistgrip tool that utilizes a more natural wrist position. In addition to aiding with gripping and bending, many of the tools mentioned help with diminishing strength and endurance. The handle-it back saver distributes weight so less strength is required for lifting. The racheting pruner is wonderful for people who have difficulty cutting with regular pruners. These pruners require very little pressure to cut through small branches.

Many of these adaptive tools are on display in the Morrison Horticultural Demonstration Center classroom. The horticultural therapy program offers courses on adaptive gardening techniques, and Denver Botanic Gardens' Helen Fowler Library has books with more information on gardening for life techniques.

Your best resource is your own body, so listen to what it is telling you, and find tools and techniques to fit your needs and preserve that valuable resource.

From the Ground Up

by Janet Laminack

Denver Botanic Gardens Morrison Horticultural Demonstration Center garden. Photo: Moss Cremer.

The Morrison Horticultural Demonstration Center at Denver Botanic Gardens is a display area for adaptive garden design. There are garden structures and containers that can be tended with little physical strain, strength or agility. These structures often will have raised soil levels which put the garden where one can best tend it. Raised beds provide body-friendly gardening and access for gardeners who use wheelchairs.

The Morrison Center is a fully accessible facility that also demonstrates small-space gardening techniques. The containers, window boxes and shelves on display are sure to provide apartment dwellers with many ideas so that they, also, can partake in gardening for life. The Morrison Center courtyard is a great garden to learn from, as well as to simply enjoy for its beauty and diversity.

Raised Bed Gardening

Not only is a raised bed accessible to everyone, but it makes gardening easier on your body.

Before building your own bed, a visit to the Morrison Center would be valuable for visualizing what your personal needs are for a raised gardening structure. Some bed designs include a bench area surrounding the planting space. This bench would be a welcome addition for a gardener who wishes to sit and garden. However, for a gardener in a wheelchair this is a non-gardening area that must be reached across in order to garden.

The width and height of a bed also are dependent on the gardener. The bed should not be wider than can be reached — measure your reach to customize your structure. On average, if it is accessible from both sides, the bed should not be more than 4 feet wide to be reached from a seated position, such as a wheelchair or bench. The height of a bed also can vary greatly, depending upon your needs. Some structures are only slightly raised, while others can be tall enough to be gardened from an upright standing position. For a gardener in a wheelchair, measure from the ground to an inch above the knee for a forward approach to the planter. The depth of the bed should be at least 6 to 8 inches.

Raised beds also can be customized by building material. Brick and cinder blocks are very durable choices, but construction can be quite labor-intensive. Brick tends to be more attractive than cinder blocks, but does not provide holes that can be planted. When choosing wood, the use of a naturally rot-resistant wood such as redwood is ideal, although expensive. For food production, treated wood of any kind could be dangerous and is not recommended. To help extend the life of the wooden bed, line it with a thick plastic.

The bottom third of a raised bed planter can be filled with crushed rock or gravel to allow for good drainage and reduce the amount of soil needed. Fill the bed with soil or other planting medium, adding enough to allow for settling. Use a planter mix or make your own mix with two parts garden soil and one part compost.

These instructions are for a basic open box style wooden raised bed. The dimensions are approximately 2 feet high by 4 feet wide by the length desired. In choosing the length, consider that lumber comes in standard lengths of 8, 10 or 12 feet.

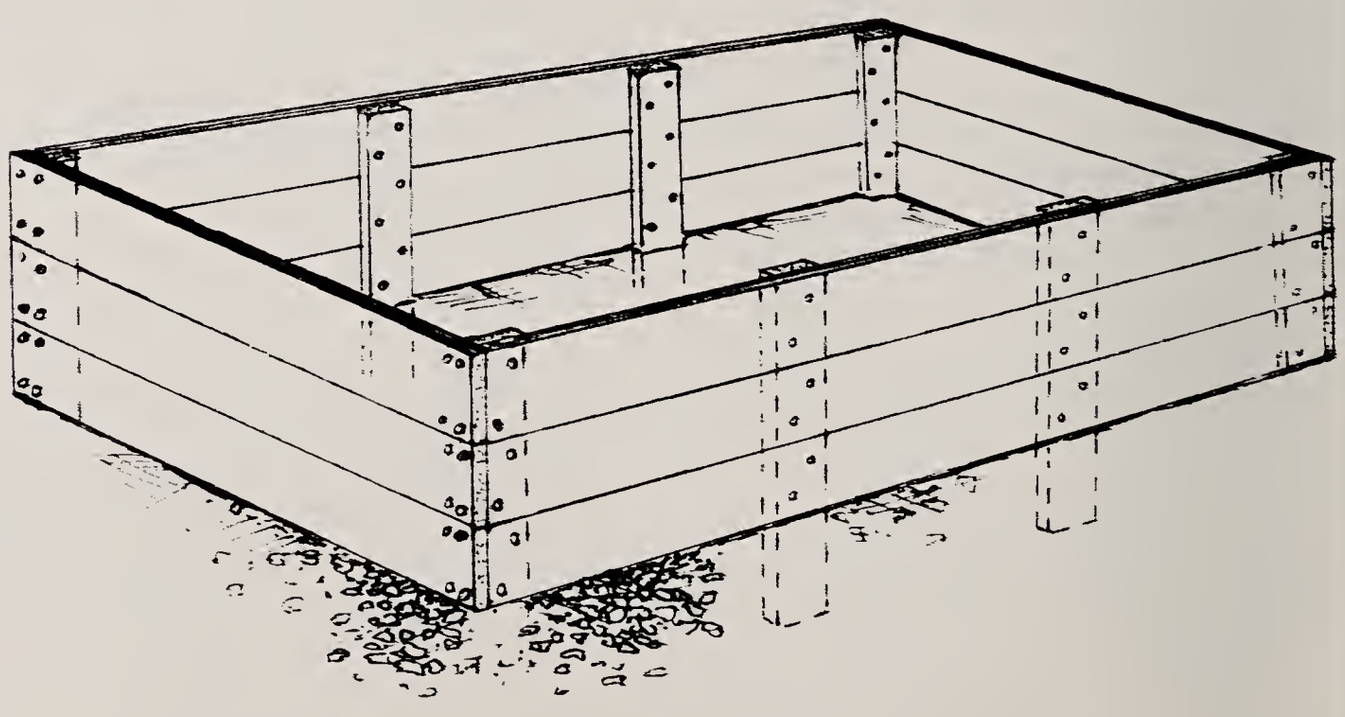


Illustration: Jack Kramer.

Containers at the Morrison Center gorden. Photo: Denver Botanic Gardens.

Container Gardening

Containers are a good way to begin gardening in a raised structure because they are pre-made and portable. You can experiment with the size of planting space and your gardening needs with containers before building a raised bed.

A few considerations specific to container gardening are their need for frequent watering and that plants may not overwinter in containers. An advantage of container gardening in a cool mountain climate is that the soil better absorbs and retains heat.

At the Morrison Center, flue tiles are used as containers because they are large, relatively inexpensive and match the clay pots used. Clay pots and flue tiles also are heavier than plastic containers. When moving around a display this is a disadvantage, but for containing tall or top-heavy plants it is an advantage. Whiskey barrels also are popular planting containers. With a liner, a whiskey barrel makes a great water garden.

Constructing a Raised Bed Planter

1. Using 2" x 8" boards, lay out the bottom layer of boards in a rectangular box-shaped frame.

2. Attach the corners with two screws (use 2 1/2" drywall screws or 3" deck screws) at each corner

3. Make two more box-shaped frames the same way.

4. Stack the three frames to make a 22 1/2" tall bed.

5. Secure the 2" x 4" braces in each corner with screws to tie the three frames together. Both sides of the frame should be securely attached to the corner braces to withstand the outward pressure of wet soil over time. (Add an extra row of screws at each corner to secure the end pieces to the braces.)

6. For sides longer than 4 feet attach a 2" x 4" board to the inside with screws for every 3 feet in length.

7. If the bed is not on a hard surface, make the 2" x 4" board longer, and stake it in the ground before attaching, to keep the sides from bowing out.

Vertical planters at the Morrison Center garden. Photo: Moss Cremer.

Vertical Planters

Gardening in vertical planters is another way to reduce bending and kneeling often associated with ground-level gardening. Vertical planters also take up less space and can create a living privacy screen or divider.

At the Morrison Horticultural Demonstration Center, there are two vertical planter designs: a window box and a display shelf. The window box style is two-sided, each side containing two narrow planting boxes which resemble window boxes. One of the boxes is at a height so that a standing adult has close proximity to the sights and smells of the plants; the other box is lower, and thus, enjoyable for children. The display shelf planter has three shelves on each side, where potted plants are stacked for impact and conservation of space.

What kinds of plants do best in containers and planters? At the Morrison Center, practically all plants are put in containers. A visit to the Morrison Center is a good way to see the plants "in action." You can see the spacing, the container size and the performance of the plant throughout the season. Additionally, the horticultural therapy program offers courses on raised bed construction and growing in containers. Check the Denver Botanic Gardens' course catalog for times these classes are offered. Denver Botanic Gardens' Helen Fowler Library also has more information on specifics of growing in containers and raised bed design.

Gardening Safety Tips

from Denver Botanic Gardens' Great Gardening Guide: "Gardening for Life."

As a form of exercise, gardening can improve your flexibility and strength. But it also can be very tiring and stressful on the muscles, joints and heart. Since fatigue is the cause of many garden accidents, it is important to know and respect your physical limits. The following safety tips can help you care for your body while you care for your plants.

Be sure to check with your doctor before starting any exercise program, including gardening.

Warm up before gardening with a few minutes of simple stretching and bending exercises.

Wear sturdy gloves and shoes with closed toes and non-slip soles.

Wear a hat and sunscreen—even on cloudy days.

Take a plastic container of water or juice with you into the garden and drink from it frequently.

For peace of mind take a portable phone or whistle with you into the garden to summon help if you should need it.

Perform your hardest garden chores first.

Change positions often and stretch occasionally.

Avoid stretching your back, arms or legs beyond a comfortable reach.

Bend your knees when lifting heavy objects—not your back. Better yet, get someone else to lift them.

Take frequent rest breaks, and stop before you become too tired.

Keep paths and open areas clear of tools, hoses and other items that may cause you to trip or lose your balance.

Be especially careful on wet grass, mud or wet pavement.

By following just a few precautions, you will not only enjoy the relaxation and mental stimulation associated with gardening. You actually will benefit physically, as well.

Ruth Davis practices safe gardening in her community garden. Photo: Moss Cremer.

Plants for Senior Gardeners

by Ken Slump, Denver Botanic Gardens Plant Records Manager

Following is a list of plants that require little maintenance or pruning, are pest or disease resistant or are suitable for container gardening.

• Chives (*Allium schoenoprasum*)—Onion-like flavor for salads and cooking without bulbs to plant, then later dig.

• Parlor palm (*Chamaedorea elegans*)—A graceful yet durable indoor plant that is considerably less messy than many houseplants.

• Early Summer Crookneck squash (*Cucurbita pepo* 'Early Summer Crookneck')—One of many bush type squash that will occupy less room and be easier to harvest than vining varieties.

• Red Plume gaillardia (*Gaillardia* 'Red Plume')—A pest free plant that flowers all season without deadheading.

• Skyline thornless honeylocust (*Gleditsia triacanthos* var. *inermis* 'Skycole')—Although generally over-planted in our area, this and other thornless honeylocust cultivars offer senior gardeners a sturdy tree with small leaflets that don't require raking in fall.

• Impatiens (*Impatiens* cvs.)—Easy flowering, colorful annuals for partially shaded gardens or containers.

• Junipers (*Juniperus* cvs.)—Pest free evergreens that should not be sheared. Do your homework and select a cultivar with the mature height and spread that will suit the site.

• Patio tomato (*Lycopersicon esculentum* 'Patio')—A small-fruited variety suitable for container cultivation.

• Donald Wyman crabapple (*Malus* 'Donald Wyman')—The fruit won't create a mess under this disease resistant cultivar because it persists on the tree until eaten by birds during the winter months.

• Garden Delicious apple (*Malus* 'Garden Delicious')—The tree is very dwarf (5 to 6 feet) but the fruit isn't. However, most fruit trees may be purchased in either dwarf or standard sizes.

• Blue Lake bean (*Phaseolus vulgaris* 'Blue Lake')—One of many bush type snap beans. It takes up less room and is easy to harvest.

• Goldsturm rudbeckia (*Rudbeckia fulgida* 'Goldsturm')—One of the best "black-eyed Susans." A more colorful, free flowering perennial with a longer season of bloom would be hard to find.

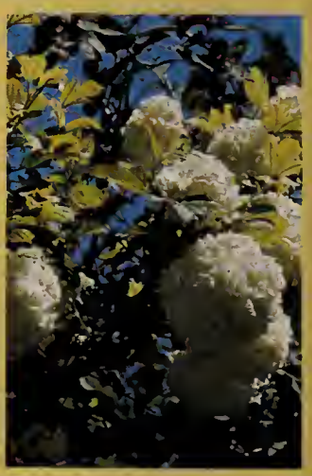
• Christmas cactus (*Schlumbergera bridgesii*)—This and other succulents are ideal candidates for low-maintenance houseplant enthusiasts.

• Turkish veronica (*Veronica liwanensis*)—A creeping, low-maintenance ground cover with the bonus of eye-catching blue flowers in May.

• Viburnum (*Viburnum* spp.)—Landscape plant expert Dr. Michael Dirr writes "A garden without a viburnum is akin to life without music and art." This is a fascinating, variable genus of very ornamental, low-maintenance shrubs.

Impatiens (*Impatiens cv. walbrana*) Photo: Denver Botonic Gardens

Juniper (*Juniperus cammunis* vor. *minima*) with *Erinus alpinus*
Photo: Denver Botanic Gordens



Viburnum (*Viburnum opulus*)
Photo: Denver Botonic Gordens

DO YOUR PLANTS TALK BACK TO YOU?

GREEN NATURE/ HUMAN NATURE

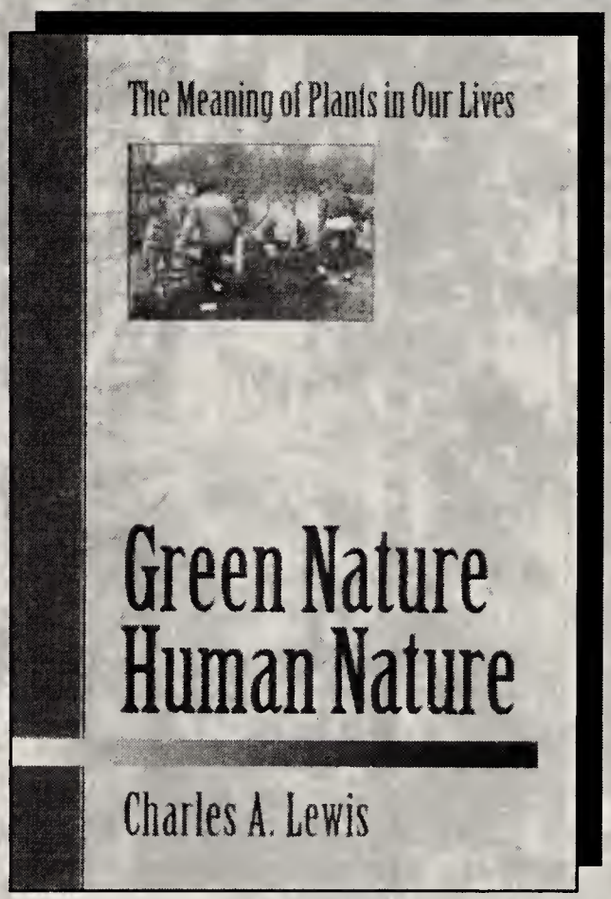
The Meaning of Plants in Our Lives

CHARLES A. LEWIS

Why do gardeners delight in the germination and growth of a seed? Why are our spirits lifted by flowers, our feelings of tension allayed by a walk in a forest or park? What other positive influences can nature have on humanity?

In *Green Nature/Human Nature* Charles A. Lewis describes the psychological, sociological, and physiological responses of people to vegetation in cities and forests, as well as in horticultural therapy programs in hospitals, geriatric institutions, physical rehabilitation centers, drug rehabilitation programs, and correctional institutions. He presents an evolutionary basis for the human attraction to plants. People-plant interactions are presented from two perspectives: participatory, in which the individual is involved in planting and maintaining the vegetation, and observational, in which the individual bears no responsibility for establishing or maintaining the vegetation.

In what amounts to a straightforward catalog of well-documented and tangible benefits, Lewis brings the latest and best research into plant/human interaction to bear on questions of how green nature is intertwined with the human psyche and how that interaction can lead to enhanced well-being and an appreciation of the human dimension in environmental concerns.



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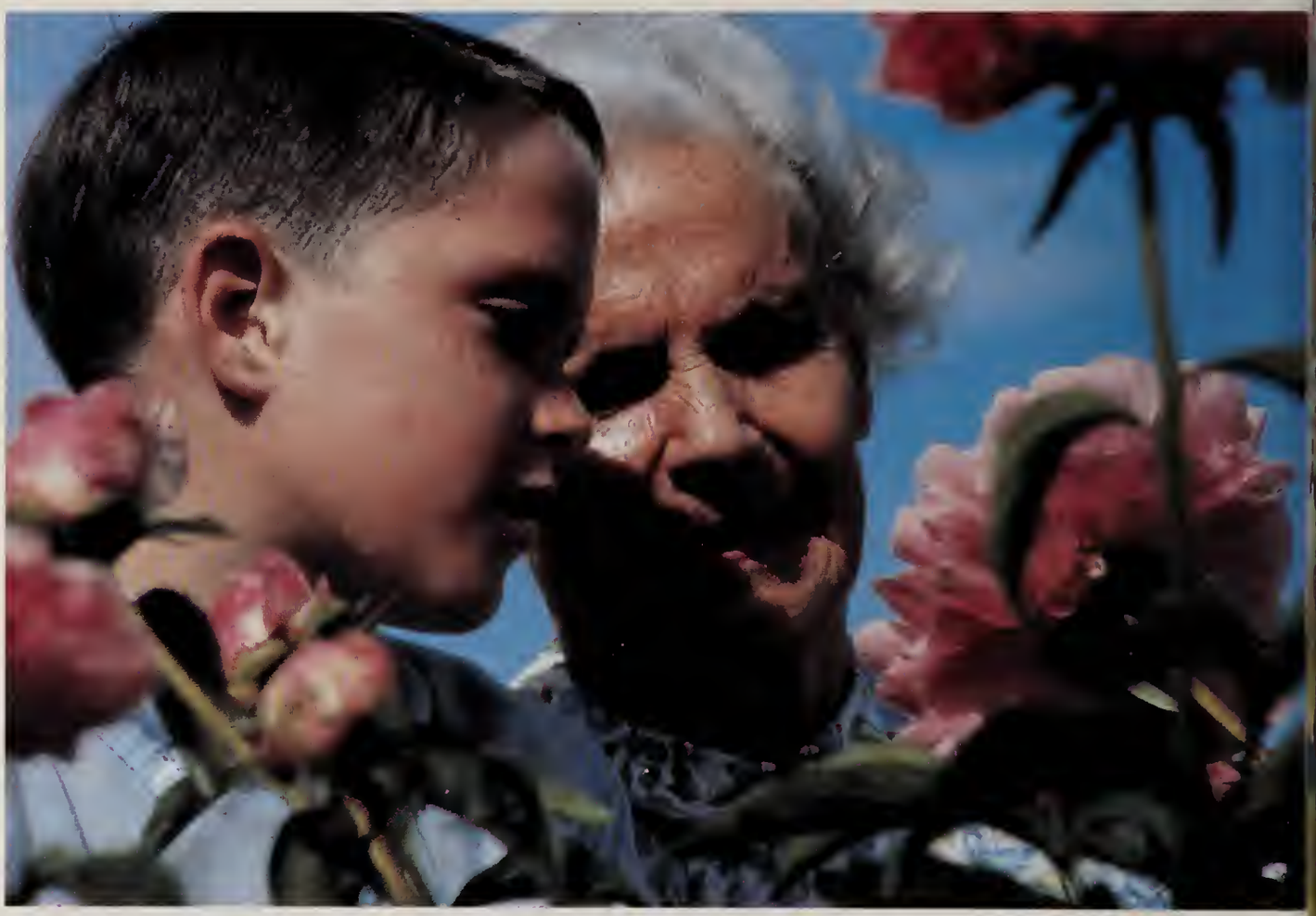

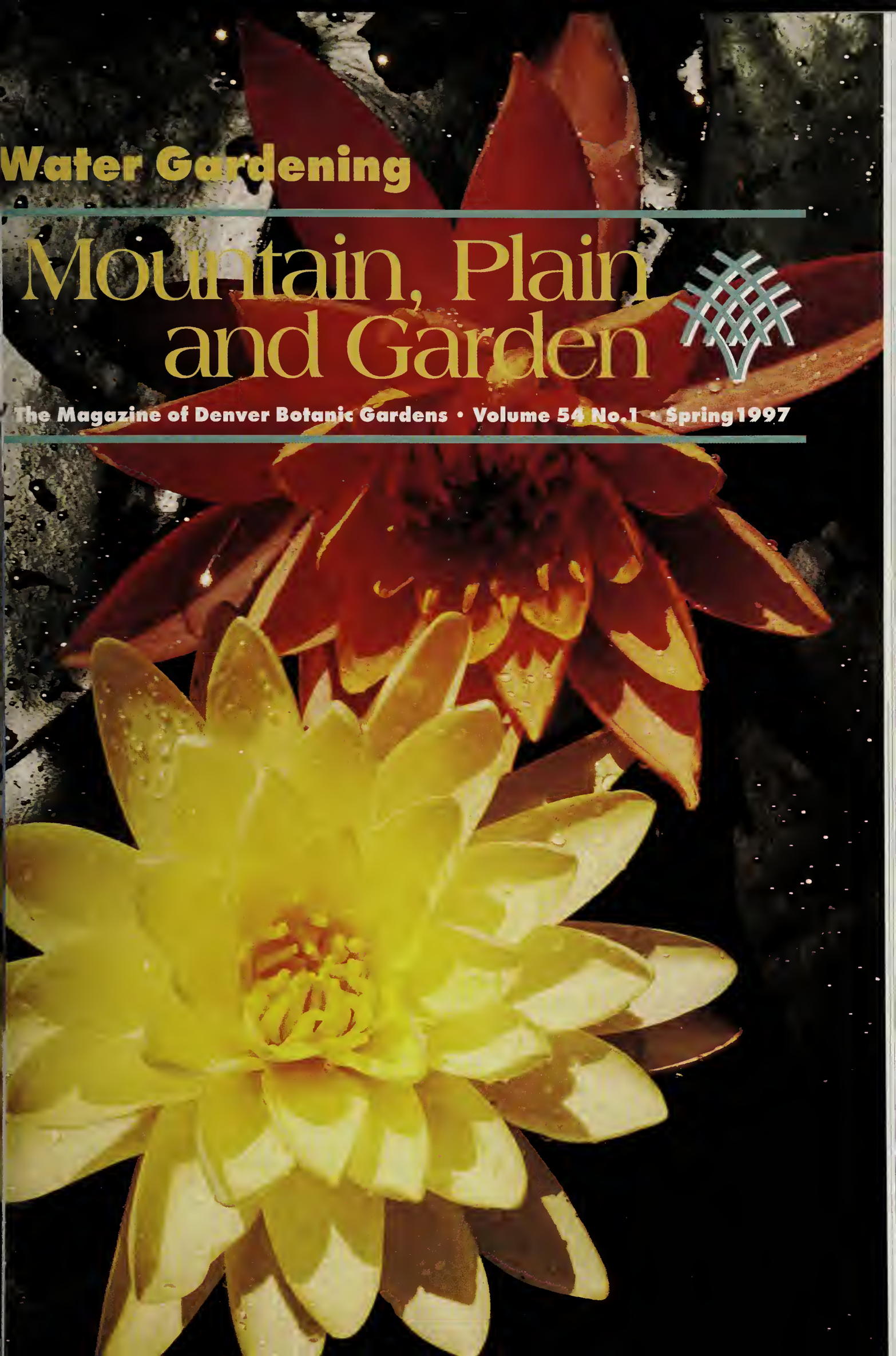

Water Gardening

Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens • Volume 54 No.1 • Spring 1997

Water Gardening at Denver Botanic Gardens

Nymphaea 'James Brydon' and *N.* 'Joey Tomocik'. Photo: Joseph V. Tomocik.

Denver Botanic Gardens Water Gardens

by Joseph V. Tomocik

Joseph V. Tomocik has been responsible for all phases of Denver Botanic Gardens' water gardens since his employment nearly 17 years ago. He has lectured extensively and is the primary author of the recently published book Water Gardening.

From the large pool near the scripture garden, the water flows past and through some eloquently designed and meticulously manicured gardens, including the May Bonfils Stanton Memorial Rose Garden, the butterfly garden and the Japanese garden. It continues under the Japanese foot bridge as it moves to the west pond. From there the water is pumped underground to begin its journey again in the large pool adjacent to the scripture garden. The sounds of water fill the air with sweet music as it tumbles, surges, glides and roars. Add the colorful water lilies, softly swaying marginals, mallard ducks, artists, photographers and countless visitors—it becomes a garden of inspiration. It's a garden to enjoy. It's Colorado's answer to Monet's garden at Giverney. It's the water gardens at Denver Botanic Gardens. Following is a closer look.

Hardy Water Lilies

Hardy water lilies are easy to grow and hard to kill. Colorado's climate is excellent for the hardy water lilies as they enjoy the long dormant period provided by our cold winters. Hardies are planted in mid- to late-April at Denver Botanic Gardens (DBG). Flowering may begin in May if the weather is warm enough, and it continues well into September. July and August are peak months.

A heavy garden soil such as clay loam is ideal for the hardies. It is important to use a heavy, fertile soil—it's amazing how well plants perform in a heavy soil. Containers can vary in size from five gallons to three bushels for show plants. Plants in larger containers are fertilized monthly by pushing fertilizer bombs, made by wrapping three tablespoons of a low analysis

Nymphaea 'Rosy Morn'. Photo: Joseph V. Tomocik.

fertilizer (5-10-5, 6-10-4, for example) into paper towels, under the plant's crown. Three to five fertilizer bombs are used for large plants grown in three-bushel containers. Water lilies in smaller containers are fertilized by using tablets made specifically for aquatics; follow package directions. The last fertilizer application should be made in late August or early September.

Several of my favorite hardy water lilies came from Sue and Larry See of Moore Water Gardens, Port Stanley, Ontario, Canada in 1986. *Nymphaea* 'Indiana' (hybridizer: Latour-Marliac) is exquisite with orange-red blossoms. *N.* 'Lucida' (hyb.: Latour-Marliac) has vermilion star-shaped flowers and rich purple marbled foliage. Its flowers close later in the afternoon than any other hardy water lily. *N.* 'Arc-en-Ciel' (hyb.: Latour-Marliac) has the most striking leaves, blotched with purple, white and bronze. It is a wonderful selection for partial shade because it is impressive even without blooms. *N.* 'Pink Sensation' (hyb.: Slocum) and shell pink *N.* 'Rosy Morn' (hyb.: Johnson) are favorite pinks.

One of the most prominent water lilies in DBG's pools is the cup-shaped, red flowering *N.* 'James Brydon' (hyb.: Dreer). A survey conducted in conjunction with the publishing of *Water*

Marginal prairie cord grass (*Spartina pectinata*) with tropical water lily *Nymphaea* 'Albert Greenberg.' Photo: Joseph V. Tomocik.

Gardening, one in the series of *The American Garden Guides,* established *N.* 'James Brydon' as the most popular water lily in America. The second most popular water lily, according to the survey, is *N.* 'Joey Tomocik' (hyb.: Strawn). Both are pictured on page 4. A bright yellow hybrid, *N.* 'Joey Tomocik' has been outstanding for DBG in recent years. On a sad note, the white species water lily *N. odorata* has somehow escaped our collection. I personally collected the plant from Loon Lake in Freedom, N.H., where I taught school some 30 years ago. Maybe I can get it back some day.

Upon visiting your neighborhood nursery, you may not find some of these recommended varieties. But don't be afraid to try something new. You might be pleasantly surprised. Each water lily has a special uniqueness.

DBG's pools are drained in October and hardy water lilies are moved to tanks between our greenhouses, stored in a bin and mulched with leaves or stored in the Botanic Gardens House basement after having leaves and roots removed. The temperature in the basement averages near 40° F in the winter. The rhizomes are packed in moist peat moss and stored on shelves.

Tropical Water Lilies

Tropical water lilies are dynamic, with fragrant blooms held high out of the water. Unlike hardy water lilies, tropicals can be blue or purple. They are larger than hardies. Most tropicals are planted in seven-gallon containers in mid-June. Planting times can be advanced or delayed according to the weather. Healthy plants are grown easily, just like hardies, in a clay loam. Lilies are planted in the center of a container and fertilized approximately every three weeks with an aquatic tablet fertilizer, the same as noted for hardy water lilies. After planting, it may take two to three weeks for plants to root and initiate growth.

Tropical water lilies bloom into October, later than hardies. Leaves turn a brilliant red on many varieties as fall approaches. Plants can be tossed after harvesting the acorn-size tubers from beneath the crowns. At DBG plants grown in 4-inch pots always produce tubers as they go dormant in the fall. They are grown in the greenhouse, and some are moved outside in the summer. They can be grown either in a greenhouse or outdoors, as long as the water temperature is at least 70° F.

Tubers are stored in 55° F water and are used to start new plants in the spring. Over the years the procedure has been altered in small ways. DBG's growing process is similar to the one initiated by Missouri Botanical Garden in St. Louis, though the process of storing tubers is different. The procedure also is practiced by Longwood Gardens in Kennett Square, Penn.

The foundation of DBG's tropical water lily collection was a generous donation from the Missouri Botanical Garden in 1985. Longwood Gardens, hybridizers and nurseries have added to the collection. We are fortunate to have lost very few varieties—our objective has been to preserve all new additions. The collection is varied and substantial.

Popular and outstanding varieties include hybrids of the legendary Dr. G. H. Pring. Examples are the purple *N.* 'Judge Hitchcock', yellow *N.* 'St. Louis Gold' and huge white night bloomer *N.* 'Missouri'.

Varieties with variegated or mottled foliage are truly impressive. *N.* 'Leopardess' (hyb.: Randig) is perhaps the most exotic—it is a sprawling plant with striking cobalt blue blooms. The green leaves are heavily mottled with maroon. *N.* 'Albert Greenberg' (hyb.: Birdsey) with sunset-color blooms of pink, orange and yellow received top votes in the survey previously mentioned. *N.* 'Evelyn Randig' (hyb.: Randig), with deep magenta blooms, is gorgeous. Favorites nationally and at DBG are blue *N.* 'Aquarius' (hyb.: Nutt) and the crimson flowering night bloomer *N.* 'Antares' (hyb.: Nutt).

The largest of the day-blooming tropicals are the star water lilies, crosses of *N. flavorvirens* and *N. capensis* var. *zanzibariensis*. *N.* 'Blue Star' (hyb.: Sturtevant) is easy and impressive. *N.* 'Rhonda Kay' (hyb.: Landon), a purple star water lily, comes higher out of the water—more than 16 inches—than any other tropical. *N.* 'Orchid Star' is very easy to propagate. *N. caerulea*, the blue lotus of the Nile from North Africa, is easily grown from seed and quite tolerant of cold water. We display it in the scripture garden.

Lotus

With huge leaves and fragrant blooms reaching high out of the water, the lotuses (*Nelumbo* spp.) are exciting. This plant is for the daring Denver gardeners. It flowers almost without exception at DBG—in home gardens it is a bit more difficult. I float healthy tubers in 60° F water in the greenhouse, moving them into warmer water a week or two prior to planting outside in early May. I like to see tiny pink roots in the constricted areas of the tuber, indicating the plant is breaking dormancy, before planting.

Lotuses begin blooming for us in July, after the hardies but before the tropical water lilies. When our pools are drained in autumn we mulch the lotuses with leaves for the winter. We remove the mulch in April and carefully divide the banana-like tubers, then float the tubers in cold water, as stated above, until planting time. We change water often as slime gathers on the tubers.

Nelumbo 'Mrs. Perry D. Slocum' (hyb.: Slocum) with changeable blooms, opening a deep pink color then turning a soft yellow, is consistently the best performer for us. Other selections of merit are *N. nucifera* 'Empress' (hybridizer unknown) with white and pink petals; pink and cream *N. nucifera* 'Chawan Basu' (hybridizer unknown); and *N. nucifera* 'Ben Gibson' (hyb.: Slocum), with pink petals and red veins.

Victoria Water Lily

The giant water platter—the Victoria water lily—is displayed each year at DBG. It is planted near June 25 and does not flower until August or September. Two varieties are grown at DBG: *Victoria cruziana* and *V.* 'Longwood'. Seed is germinated in 70° F water in February or March. I always have a secondary source for the Victorias as they are touchy in the seedling stage. Sudden changes in water temperature can be lethal. I feed the Victorias heavily about every 10 days with a combination of granular fertilizer and fertilizer tablets. Leaf size varies, reaching 50 inches or so during most years.

In Denver, cold water is the limiting factor in growing Victorias. The new leaf emerging from the crown must be intact at planting time. Recent work by avid Victoria growers should stimulate new interest and bring more Victoria varieties to water gardens.

Marginals

Adding an exciting array of colors, shapes and sizes, marginals are fun and interesting elements in a water garden. Except for those with floating leaves, marginals can be planted in moist soil adjacent to pools or submerged in containers, like water lilies.

Tropical marginals can be planted outside after May 15 and should be brought into the greenhouse for the winter.

Hardy plants can be over-wintered outside, covered with a mulch of bagged leaves to protect against freezing. The mulch should be removed in late April and the plants divided before water is added to the pools.

A heavy garden soil (clay loam) is an excellent growing medium for marginals because it retains nutrients well and allows for healthy rooting. Marginals should be fertilized at about one-half the rate recommended for water lilies.

The tall, showy marginal seen in large numbers each summer in DBG's pools is white rush (*Scirpus albescens*). It grows taller than 6 feet in seven-gallon containers. Three additional Colorado natives that are easy to grow, interesting to look at and hail-resistant are sweetly scented sweet flag (*Acorus calamus*), tall graceful cattail (*Typha angustifolia*) and broad-leaved arrowhead (*Sagittaria latifolia*).

Effective tropical marginals include the umbrella plant (*Cyperus alternifolius*), papyrus (*Cyperus papyrus*) and colorful Longwood hybrid cannas (*Canna* 'Ra', *C.* 'Erebus' and *C.* 'Endeavor'). New additions in 1997's displays will include an electrifying orange flowering canna with yellow and chartreuse striped foliage (*C.* 'Pretoria') and Indian Bayou powdery thalia (*Thalia dealbata*), a newly collected form from the USDA in Coffeeville, Miss.

Container Gardens

Small container gardens are easy, fun and a wonderful way to get started in water gardening because they can fit just about anywhere. Last year DBG had nine container water gardens. For an easy and effective display combine prairie cord grass (*Spartina pectinata*), sweet flag (*Acorus calamus*) and chameleon plant (*Houttuynia cordata* 'Chameleon').

DBG Water Lily Trials

The water lily trials are used to display and evaluate new water lilies from the world's finest hybridizers, including Kirk Strawn, Perry D. Slocum and Kenneth Landon. The red *Nymphaea* 'Perry's Baby Red' (hyb.: Slocum) and yellow *N.* 'Joey Tomocik' (hyb.: Strawn) have achieved national and international acclaim. The red and white bicolor *N.* 'Mary' (hyb.: Strawn) is a favorite at DBG. *N.* 'Colorado' (hyb.: Strawn) is getting rave reviews as the world's first salmon-colored water lily. A soft yellow *N.* 'Denver' (hyb. Strawn) will be formally introduced this year and should be a fitting partner to *N.* 'Colorado'. Both are pictured on the cover.

Of special interest is a water lily in Berkeley Lake located in northwest Denver's Berkeley Park which, evidently, has evolved through years of crossbreeding. Some of the plants are white, others are pink. Cuttings have been transplanted to Harvey Park Lake in Harvey Park, southwest Denver, and this versatile water lily is a great candidate for naturalizing in other lakes as well.

Additional plants will find their way to the trial area this year, including hybrids from hybridizers Reg Henley, Michael Duff and Don Bryne.

Making It Work

DBG participates in plant exchanges with other institutions. We do our best to meet requests from botanic gardens and have sent plants to some very unlikely places.

My involvement with the water gardens at DBG spans a period of nearly 17 years. It has been enjoyable and exciting. With the aid of my supportive supervisors and co-workers, I am happy to share our accomplishments with the public. I appreciate the contributions of so many interns, seasonal workers and volunteers including volunteers of the Associates of Denver Botanic Gardens and the Colorado Water Garden Society.

Remember, "Everyone's a water gardener, some people just don't know it yet!"

Trial Water Lilies at Denver Botanic Gardens

by Rebecca Nash and Carla & Neil Littlefield

Rebecca Nash is a full-time Realtor and financial consultant who enjoys the opportunity to "unwind" by volunteering in Denver Botanic Gardens' water gardens. Carla Littlefield is a grant writer and research consultant for local and state agencies. Neil Littlefield has taught at the University of Denver since 1970. The Littlefield's water garden was featured in the 1996 Colorado Water Garden Society pond tour.

At Denver Botanic Gardens, we have volunteered for two years under the guidance of aquatic horticulturist Joe Tomocik, working with the trial water lilies. Denver Botanic Gardens' collection is one of fewer than 10 trial collections sponsored and certified by the International Water Lily Society. New water lilies in the market may also be placed with the trial water lilies. The trial water lilies include progeny of such noted hybridizers as Perry Slocum, Kirk Strawn, Ken Landon and others. Among the new water lilies that have graduated from the test collection over the years are *Nymphaea* 'Joey Tomocik' (hybridizer: Strawn), named for the daughter of Joe Tomocik, *N.* 'Denver' (hyb.: Strawn) and *N.* 'Colorado' (hyb.: Strawn). The latter is the first salmon-pink hardy, and its beautiful blooms are carried 4 inches above the water.

The trial program begins in the spring when water lilies are removed from winter storage or are received from the hybridizers. During 1996, some water lilies provided by Henley Gardens in England also were added. Data about the rhizomes is carefully recorded, including size, condition, number of eyes and planting date. The water lilies then are placed in appropriate pots and labeled.

From this point on, volunteers check the progress of the water lilies weekly, taking careful notes regarding the plant's general appearance, amount of growth, leaf size and color, bud count, blossom count and spent bloom count. Also, the color, size, fragrance and type of blossoms are noted.

The plants are carefully fertilized on a regular basis. Specially formulated fertilizer tablets are applied every three to four weeks in recommended dosages according to instructions provided by suppliers.

Nymphaea 'Mary'. Photo: Joseph V. Tomocik.

At the end of the season, the plants are taken from the water, removed from their pots, cleaned and measured again. Careful notes are taken regarding the pattern of growth of the root system, number and size of newly developed eyes, color and firmness of the roots, and number of buds still forming. Some water lilies put on rampant growth with many new eyes while others develop quite slowly. Those that are slow to form eyes could be difficult and expensive to propagate.

After all the data has been recorded, the water lilies are stored in flats of dampened peat moss for the winter. The flats are placed in a cool basement where they remain until the following spring. Each spring a decision is made whether to include them in the next trial. Most plants are evaluated for at least two years.

The data gathered in the water lily trial is useful in a number of ways. Hybridizers are interested in how the plants do in Denver. Summarized results are published in various journals, making the information available to many people. The trial is operated with the home gardener in mind.

Water Gardening Techniques

Canna 'Pretoria'. Photo: Joseph V. Tomocik

Small Container Water Gardening in Half Whiskey Barrels

by Larry Knowles

Larry Knowles has volunteered at Denver Botanic Gardens since April 1989, soon after his retirement from the National Park Service as a landscape architect. He has worked in the greenhouses with aquatic horticulturist Joe Tomocik for eight years, helping him care for water plants.

The first half whiskey barrel for my home garden was purchased in 1990. In 1992 two more were added, and by 1995 my collection had grown to five. This has been a new and interesting aspect of gardening which has given me a great deal of pleasure. I hope this article stimulates you, also, to experience the pleasures of small container water gardening.

The first step in container water gardening is preparing the wood barrel. A suitable type is a whiskey barrel sawed in half, available at most garden supply stores. It is made of oak wood staves held together by three metal rings stapled to the staves. The staples don't last, so without reinforcement you could end up with a pile of staves when the metal rings slip down. I recommend drilling small holes through these metal rings and each stave, then securing with a 1-inch deck screw. If this is done on a hot day with the sun beaming down into the barrel, fumes of an intoxicating nature may help you forget the heat!

Next, drill a hole through a wood stave on the side and near the bottom of the barrel just large enough for a one-half- or three-quarter-inch plastic or metal pipe. Screw a ball valve into the pipe, then screw the pipe into the barrel hole so the barrel can be drained of water. A full barrel is too heavy to move, and water needs to be gradually replaced. Emptying with a bucket is a slower method.

Prepare a level, firm platform such as a concrete slab, and place your barrel on it. This will prevent the wood barrel bottom from rotting as fast as if it were placed on soil. When you first fill the barrel with water it will leak a lot. The wood will start swelling from the bottom of the barrel to the top. Eventually, the wood staves will swell tightly together so the leaking stops; however, this can take two to three weeks of filling up the barrel with water daily.

Unpleasant odors will develop and little white worms and mosquito larvae will appear. Replace the water frequently by opening the ball valve to get rid of these. Plants seem to tolerate the worms, larvae and water replacement and will do just fine. A plastic liner in the barrel would prevent some of these problems. However, water replacement would be more difficult. You can make a leakproof seal for a drain pipe through the liner and wood side of the barrel so water can be drained through the ball valve without filling the space between the liner and the wood. I have not tried it since liners can cost more than the barrel, and my system works.

Most water plants do best in full sun. Place all plants requiring soil in containers, covering the tops with small rocks so light material can't float to the surface. Don't place soil in the bottom of the barrel because this will plug up the drain pipe. Remove spent flowers and thin out plant growth, especially with floating plants which can take over before you know it and look messy. At first this thinning seems a terrible thing to do. But you can give these thinnings to friends, start another water garden or put them in your compost bin. Remove dead and decaying vegetation—these can smell bad. Replace about half of the water once each week by opening the drain valve at the bottom and adding fresh water to the top of the barrel. Top off the barrel frequently since water evaporates rapidly during periods of low humidity, so com-

Container water garden at Denver Botanic Gardens. Photo: Denver Botanic Gardens.

mon in the Denver area. Fertilizing with small tablets pressed into the soil will improve the appearance of the plant's foliage and flowers. Happily, there is no weeding. All those banes to land gardening like crabgrass, dandelions and oxalis, to name a few, drown really fast!

I divide the plants that have done well for me in my wood barrels into two groups: those that float and those that require soil.

The floaters are water hyacinth (*Eichhornia crassipes*), water fern (*Azolla pinnata*), common duckweed (*Lemna minor*), water lettuce (*Pistia stratiotes*), parrot's feather (*Myriophyllum aquaticum*) and water sensitive plant (*Neptunia oleracea*). Goldfish eat the water fern.

Those that require soil are the beautiful yellow hardy water lily 'Chromatella' (*Nymphaea* x *marliacea* 'Chromatella'), yellow and green variegated canna (*Canna* spp.), dwarf umbrella plant (*Cyperus alternifolius* 'Gracilis'), dwarf cyperus (*Cyperus haspan*), water fringe (*Nymphoides indica*), fringed yellow snowflake (*Nymphoides crenata*), taro (*Xanthosoma* spp.), dwarf horsetail (*Equisetum* spp.) and lotus (*Nelumbo* spp.). The lotus produce numerous large attractive leaves, but no flowers for me or two other greenhouse volunteers, Jan Gloor, who has given me inspiration and ideas for this article, and Ted Will. Though we three were disappointed that our lotus did not produce any of the spectacular flowers for which this plant is so famous, you may have better success

Raccoons, deer and elk like to eat water plants. I'm thankful that where I live in Lakewood deer and elk are not a problem—but raccoons are! They visit at night under the cover of darkness to do their thorough investigations of water barrels. They get into the barrels, dig up rooted plants, knock over containers and chew on plants, especially water hyacinths. I have found the best defense is to secure chicken wire tightly over the top of the barrel. Screw several eye screws into the wood staves near the top on

the outside, attach snaps to these and hook the snaps into the chicken wire. Cut the chicken wire so it extends a few inches over the barrel edge. This greatly limits the destruction done under the wire. I haven't figured out a way to protect the vegetation above the wire, however the plants keep growing.

A major decision you should make initially is whether to include fish in your container. Eventually goldfish became an important part of my container water gardens due to a population explosion of mosquito larvae in my water barrels. Fish are an interesting, attractive element of color and motion. Watching them is relaxing and soothing. Children love to watch them. They don't need to be fed commercial food during the growing season as long as there is an ample supply of vegetation and algae. They eat mosquito larvae and help keep the container and plants clean. They reproduce freely. However they require additional maintenance and must be fed in the absence of live plants and in winter, if left outside.

If you decide to include fish in your water barrels, do not add them until a year has elapsed — toxins in solution from the wood can kill them. Fish and snails help keep what is underwater clean. A small submersible pump can help the fish by providing oxygen, and it provides a delightful sound of splashing water.

Raccoons, birds and cats like to eat fish. Chicken wire installation provides good protection from these predators, as does adding rocks which provide places for the fish to hide in the bottom of the barrels.

In the winter, you can either empty the barrel and bring the fish and plants inside so they don't freeze, or you can winterize the barrel and leave it outside. I install an electric bird bath heater in the barrel bottom which prevents the

Bird bath heater keeps water from freezing in the winter. Chicken wire protects fish and plants from predators. A drain pipe extends from near the barrel bottom for easy draining. Photo: Larry Knowles.

water from freezing. It is important that you can easily see if power is on at the heater connection. I do this by using an extension cord which has a light at the heater connection. At night this light is visible from our family room. As long as the light is on, the heater probably is working. If ice forms on the water surface of the barrel something is wrong. Continue to replace water during the winter. I do this during warm spells when my garden hose isn't frozen.

Goldfish and many water plants can live in our cold Denver winters if they do not freeze. Of course, plant parts above the water surface freeze and die. Fish must be fed. I knock gently three times on the side of my barrel just before putting in food, and the goldfish really come swimming!

I have had good results growing just about everything I put in my barrels, and you should, too. Water gardening is very easy and fun!

Constructing a Garden Pool

by John Mirgon

John Mirgon, organizer and first president of the Colorado Water Garden Society, has taught pool construction classes at Denver Botanic Gardens and for Jefferson County Adult Continuing Education. He co-authored the booklet, Ornamental Water Gardening: How and What to Grow, *and has spoken to garden clubs and at International Water Lily Society symposia. He is an honorary member of the Pikes Peak Water Garden Society, Colorado Water Garden Society and Wabash Valley Water Garden Society and a member of the International Water Lily Society's Hall of Fame.*

With the present-day popularity of garden pools, many people wish to build one of their own. This article should help those wondering whether they, too, can build their own. One needs only three things to build a pool: imagination, funding and ambition.

First considerations are location and benefit. Will the pool be viewed from a picture window or patio, or placed for pleasure while walking in the garden? If a waterfall is desired, will it be the feature of the pool and garden, and thus visible from a designated viewing point? Also, can the pool be located where the benefit of the sound of moving water may be heard? This may be especially desired for listening while preparing for sleep. Give as many considerations as possible to what benefits are desired.

These established, determine what will be necessary as far as materials, permits and whatever else one might wish to include.

Many materials may be used for pool construction such as concrete, fiberglass, clay and membrane liners. Most pools are constructed with membrane liners such as polyvinyl chloride (PVC), hypalon, butyl rubber and ethylene propylene diene monomer (EPDM). At present, EPDM is the most popular because it is cost-effective and easily repaired. It is a form of synthetic material very similar to butyl rubber.

When considering a liner, whatever material you might choose, be sure to ask the supplier if the material is easily repaired and, most importantly, be sure the material will leave your water potable. Toxic chemicals can leach from some EPDM liners, thus, making your water non potable, which will undoubtedly be toxic to fish and plants.

Before constructing a pool, be sure to investigate which permits are needed. Building permits probably are not needed, however, one should check with the county building department if unsure. Also check with the zoning department since the selected location may not be permitted for a pool or requirements may need to be followed. Always be sure building and zoning departments understand the pool is a water gardening pool, not a swimming pool. Plumbing and electrical permits usually are needed.

The average garden pool for goldfish and aquatic plants is 2 feet deep. Using this depth, decide the desired width and length, then find a point to work from for leveling the perimeter of the pool. Regardless of what coping is used for the pool border—sandstone, concrete, moss rock, stepping stones or whatever—the perimeter has to be as level as possible before anything is placed for the coping.

Use rope or garden hose to lay out the desired pool shape. For a 2-foot-deep pond, prepare a 2-inch square stake by pointing it on one end and driving it near the center of the pool until it levels with the leveling spot on the chosen edge. This stake will give the depth for digging. Using a 2-inch by 4-inch by 8-foot timber and leveler, or something comparable, level the rest of the pool perimeter from this driven stake. Keep in mind, if the pool isn't level when filled with water, you won't be able to get a jack under it to level it! With the perimeter decided and marked off, begin digging. The wall should be

dug at a 20-degree angle. For a shelf around the pool for shallow plants, dig down 1 foot, then out 1 foot, and down again 1 foot to the pool floor. If including a waterfall, keep in mind where it is to be, and dig the wall accordingly—a shelf below the waterfall probalbly is not desired.

When finished digging, look around for and remove any rocks, tree roots or anything that might puncture the liner. To protect the liner cover the entire excavation with old carpeting, carpet padding, layers of newspapers, a layer of moistened sand or felt-type liners purchased from suppliers.

Rather than plumbing a drain into the bottom to the sewer line, you may want to slope the pool floor to a low spot so a pump can be placed to pump the pool out, should this be needed. It is not recommended to dig a hole deeper in the bottom for the pump—the pool servicer may step in, and injury may result. Also at this stage an overflow should be placed that can carry the water away from anything in its path that could be damaged. This, too, may decide the water level.

With the excavation done and padded according to choice, it is time to install the liner. To calculate the size of the liner for a pool 2 feet deep, figure the length and width chosen and add 6 feet. This allows for a 1-foot overlap at the perimeter. As an example, a 2-foot-deep pool that is 10 feet by 12 feet will require a liner 16 feet by 18 feet. Heat from the sun will make the liner pliable and easier to install. Spread the liner over the pool as evenly as possible and place extra, if any, at the waterfall and overflow. If the pool is not even all the way around, there will be excess liner. Let the liner sag a bit and place stones or some other form of weight around the liner edge to give some resistance to the water weight when filling the pool. Do not let the liner hang up on anything. When there is 5 to 6 inches of water in the pool bottom, step in and, using your feet, be sure the liner is against the pool wall all the way around. Any gap left could eventually permit the liner to tear with the water's weight.

As the pool fills there will be no way to prevent the liner from having folds. Where possible, pull as many of the folds into one big

Photos: John Mirgon.

1) Pick on ideal location ond lay out the shape of your water garden.

2) Working from the center out, level the ground.

3) Mark the desired depth, then begin digging.

fold. This will make for a neater job when done. At this point, consider where the electric cord, hoses for a waterfall or anything else of this nature should go. Hide a PVC pipe large enough for the cords and hoses in a fold in the liner so these will not be seen when the pool is finished. If a pump or something else is added in the future, its cords, also, can be hidden in the pipe. Be sure to plan for electrical outlets needed.

With the liner placed and installed, lock it in at the perimeter. This can be done in different ways. Either dig a trench about 10 inches from the pond edge, place the liner excess in the trench

Photos: John Mirgon.

4) Dig at a 20-degree angle, using a template to ensure exactness.

5) After digging is complete, remove rock or other materials that may puncture the liner.

6) After padding excavation, spread liner over and secure with stones.

7) Lock liner at perimeter.

8) Fill pool with water.

9) Add rocks or other landscape materials and you're ready to plant.

and cover with soil. Or, plan ahead to have enough liner so it can come up behind the coping rock, or whatever finish is used, with sod placed against it. This will hold the liner and ensure the water overflow cannot get behind it, causing the pool walls to give way.

Now with the liner installed, the water can be topped off and the basic pool is done. A few other ideas should be considered:

- Keep the pool design simple. Perfectly square pools usually do not work in a garden design.
- Place the pool where the greatest amount of sunlight will be available—all day if possible, and nothing less than six hours—this amount of sunlight is the minimum and may require specific plants.
- Sandy soil may require the use of concrete or fiberglass pools. A liner can be used, but absolutely no water should get behind it from pool overflow. Loose soil may require a perimeter ring, such as concrete or railroad ties. Heavy clay soil with absolutely no rocks may not require a liner padding. Do not place the pool under trees—leaves and broken branches may fall in, potentially puncturing the liner.

• Make sure all rocks in the coping are secured so someone stepping on the pool edge will not be thrown into the pool. Any concrete in or around the pool should be neutralized of free lime. Mix one quart of household vinegar with 10 quarts of water and scrub thoroughly, then flush out to neutralize. Remember that no rocks on a pool floor make for easy cleaning. A waterfall can be built after the pool is constructed, should it be desired.

To figure the approximate number of gallons in a pool, multiply the length by the width by the depth. This will give the cubic feet of the pool. Then multiply the cubic feet by 7.5 since there are 7.5 gallons in a cubic foot. If a water meter is used remember that meters read by the hundreds, so the end figure could be plus or minus just a bit.

Another way to figure the number of gallons is to calculate how many gallons flow from the hose per minute, then how many minutes it takes to fill the pond. Take a half barrel, or anything that will hold a given number of gallons. Place an exact number of gallons in the container and mark it at a set level. Now empty the container. With a watch or timer, record how long it takes to refill the container with a hose to the indicated level. To determine gallons per minute, divide the predetermined number of gallons by the time required to fill the container to the indicated level. Note how long it takes to fill the pool, then multiply the time by the number of gallons per minute you just determined—now you have the number of gallons in the pool.

If children will be present, a fence around the pool may be required. Be sure children are safely away from the pool before leaving them unattended. Gravel or some form of rock border around the pool will help keep children from crawling in.

There is no way of knowing exactly what hazards may be encountered with garden pools, but give thought to what could happen—and avoid all dangers whenever possible.

Good luck and happy water gardening.

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Choosing Water Lilies for Home Gardens

by Rebecca Nash and Carla & Neil Littlefield

The popularity of water gardening continues to grow in Colorado as well as elsewhere. Gardeners have discovered that water gardening can be accomplished in a variety of ways. Many who begin with a few plants in a half barrel develop the urge to graduate to a backyard pool.

The pond of an experienced gardener usually contains not only the usual hardy water lilies, but also a tropical water lily or two, some marginals and perhaps even a lotus plant. Beginners usually find that gardening with hardy water lilies is a good place to start. Following is some useful information about selecting appropriate water lilies to suit your particular garden.

In selecting water lilies for a home garden, one should consider numerous factors. The great variety of hardy water lilies available justifies that care be taken in determining which ones to add to a pond. In choosing water lilies for a tub or half-barrel garden it is wise to consider several factors, including the growth rate of the plants and the scale of the leaf and flower size to the container. A large-leafed variety would rapidly fill the water surface of a half-barrel with leaves, allowing little or no room for plants such as rushes *(Juncus* spp.), iris *(Iris* spp.) or cyperus *(Cyperus* spp.). In addition, crowding would affect the overall performance of water lilies and possibly limit flower production. Appropriate water lilies for a tub include *Nymphaea* 'James Brydon' (hybridizer: Dreer) and *N. pygmaea* 'Helvola' (hyb.: Latour-Marliac). *N.* 'James Brydon' is a reliable bloomer with deep pink flowers and medium-sized dark green to burgundy leaves. *N.* 'Helvola' is a prolific bloomer with small yellow flowers and small medium green leaves. Both do well in the confined space of a half-barrel or ceramic tub.

One important factor is the overall size of the plant. Some water lilies grow within a circle of a few feet, while others spread to 6 feet or more. For example, *N.* 'Conqueror' (hyb.: Latour-Marliac) with crimson flowers has a large spread of 7 feet. Thus, the size of one's pond should be considered in selecting appropriate water lilies.

Another factor to consider is the number o blossoms and frequency of bloom. If one desires continuous blossoms of a great number at a time, select the ever-popular *N.* 'Perry's Red Wonder' (hyb.: Slocum) with a medium-size spread or the classical *N.* 'Pink Sensation' (hyb.: Slocum). On the other hand, if attracted by large startling blossoms, select *N.* 'Texas Dawn' (hyb.: Landon) with yellow blooms extending a full 6 inches above the water.

Finally, in selecting water lilies, gardeners should consider the great variety of shapes, colors and sizes of the leaf. A number of water lilies have leaves with bronze or burgundy spots, blotches or striations *N.* 'Fritz Jungel' (hyb.: Henley) and *N.* '95-1 LSKL' (hyb.: Landon) have spotted leaves. *N.* 'Denver' (hyb.: Strawn), *N.* 'Colorado' (hyb.: Strawn) and *N.* 'Peaches & Cream' (hyb.: Slocum) have blotches and striations.

There are many good sources of information for the selection of appropriate plants for your own water garden. Check in Denver Botanic Gardens' Helen Fowler Library or gift shop for some informative books that give descriptions and color photos of a bounty of water garden plants.

Propagation and Display of Tropical Water Lilies

by Stan Skinger

Stan Skinger volunteers at Denver Botanic Gardens and works extensively with the tropical water lily collection under the guidance of Joseph Tomocik, DBG's aquatic horticulturist. In real life, Skinger is employed as a youth counselor/milieu coordinator in a forensic treatment unit working with adjudicated, dually diagnosed youth.

Tropical water lilies often are thought of as rather delicate plants in Colorado, best left to the "experienced" water gardener. While there are some temperature constraints in the late spring, tropicals really do quite well in Colorado ponds.

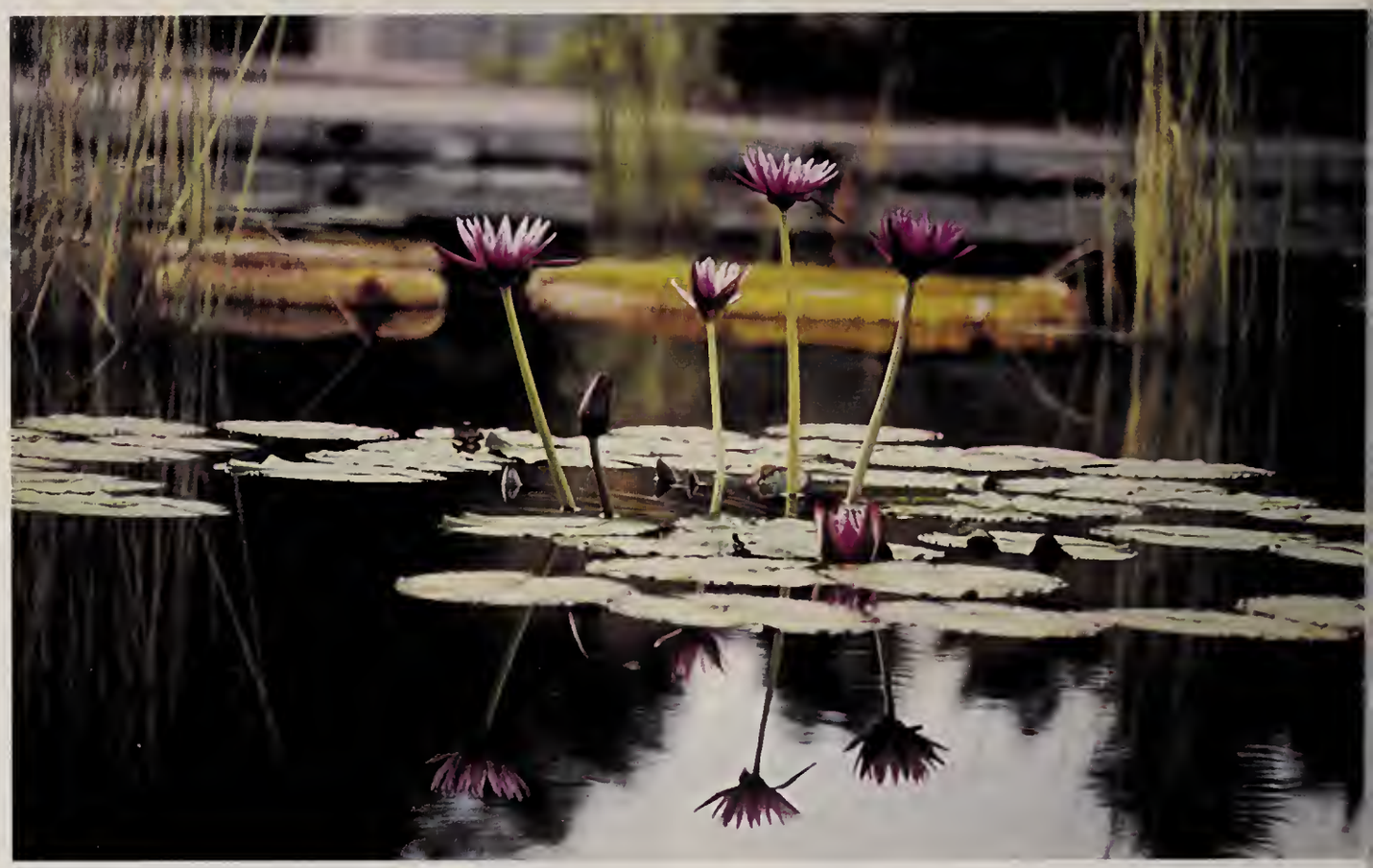
Tropicals require a water temperature of 70° F, and they need five or more hours of sunlight daily. Tropicals typically continue to bloom long after the hardy water lilies stop, often well into October. Tropicals bring intense colors unavailable with hardies, ranging from soft misty blues to deep midnight-blues, violets, lavenders, purples and oranges. They often offer the fragrance of citrus, honey, rose, pineapple and a host of other scents, some of which are indescribable and intoxicating. Night-blooming tropicals open in the early evening, stay open all night and close the following day. On cooler mornings, they may remain open through the day.

Tropicals range in size from tiny plants about 12 inches in diameter to plants that exceed 12 feet in diameter. They can be grown and bloomed in environments ranging from a whiskey barrel up to the largest pond. The size of tropical water lilies can be controlled by the size of the pot they are grown in, and in most cases, two- or three-gallon pots are ideal.

Tropical water lilies are propagated by three methods: from tubers, from seed (not addressed here) and from viviparous leaves. Tubers and viviparous leaves provide genetic duplicates of the parent plant, while propagation from seed is unreliable and often brings forth a plant unlike the parent plant due to cross pollination. The only tropical water lilies that are viviparous, or "live-bearing," are the hybrids of the species *Nymphaea micrantha*.

Nymphaea 'Emily G. Hutchings'. Photo: Joseph V. Tomocik.

With a little effort you can propagate and display your tropical water lilies year after year. While tropicals very rarely survive our winters outside, they do form a tuber similar to a potato or some begonias. You can harvest, over-winter and grow your tropicals for next year, with little fuss and bother and with minimal supplies and



Nymphaea 'Rhonda Kay'. Photo: Joseph V. Tomocik.

material. In fact, you may already have everything you need.

As autumn approaches, the plant is affected by diminishing day length, nutrients and temperature. These factors cause the water lily to produce a tuber, and it is this tuber that we must depend on for next year's plants. It is important that you stop fertilizing tropical water lilies in mid-August. If you feed too late, or if your tropical is in a pot that is too large, the nutrients may not deplete enough to allow good tuber formation. A two- or three-gallon pot is an ideal size container for a tropical water lily and will provide enough room for a wonderful specimen of 3 to 5 feet in diameter to grow. Water lilies in larger pots are less likely to produce tubers.

The investment of a few minutes in the fall when you are preparing your pond for winter and a few minutes in January to harvest and properly store the tubers will yield a tuber that can produce one to five or more plants in the spring.

Keep your plant in the pond until it stops producing flowers and leaves. This usually occurs in early October, or perhaps later, if your pond is especially warm. At that time, pull your water lily container out of the pond and allow it to drain for a day in a cool shaded area. Remove all dead and weak tissue, allowing only the smallest and firmest leaves to remain. Place the pot in a plastic trash bag, fold the bag over loosely, and store it inside in a cool location (55° F is ideal). Check the soil periodically to assure it remains moist, but not muddy.

In January, break open the soil ball and remove the tuber. Carefully clean the tuber of all loose debris and place it in a sealed bag with some water. Store the tuber in a dark location where the temperature is as close as possible to 55° F. Check it occasionally, rinsing and changing the water if it fouls.

In late March or early April, float the tuber still in the bag, in water at a temperature of 75° to 80° F. An old fish tank with an aquarium heater will be adequate, but if you don't have one, improvise something. When the tuber just begins to sprout, place it in a small pot (3-inch is fine) with three-quarters-inch of soil over the tuber, and add light to the formula. The type of light is not as important as you may think, but more and stronger is always better, and direct sunlight is ideal. Be sure 4 to 8 inches of water cover the pot for the water lily to grow properly.

In a few days the leaves will appear above the soil. Allow the leaves to grow until they are

1 1/4 to 1 1/2 inches in diameter. At this point, gently rinse the soil away and separate the small plants from the tuber, carefully retaining as many of the roots as possible while untangling them. The plants are attached to the tuber by a stolon, or runner. In the day-blooming group of water lilies it is usually quite short, making it appear that they are attached directly to the tuber. In the night-bloomers this stolon may extend several inches beyond the tuber. The tuber may then be repotted for further growth.

Do not attempt to plant the tuber itself into your pond. To do so probably will result in either a few spindly leaves without flowers or a robust multi-crowned plant with a multitude of leaves and few, if any, blooms. Grow the plants individually for best performance.

Place these plants in 4-inch or larger pots and grow them until a significant number of roots begin to leave the pot. Repot to a larger size and continue to do so as necessary until the pond warms, usually in the first or second week in June. Finally, pot plants into two- or three-gallon pots full of any rich soil that does not float, and submerge the pots in your pond.

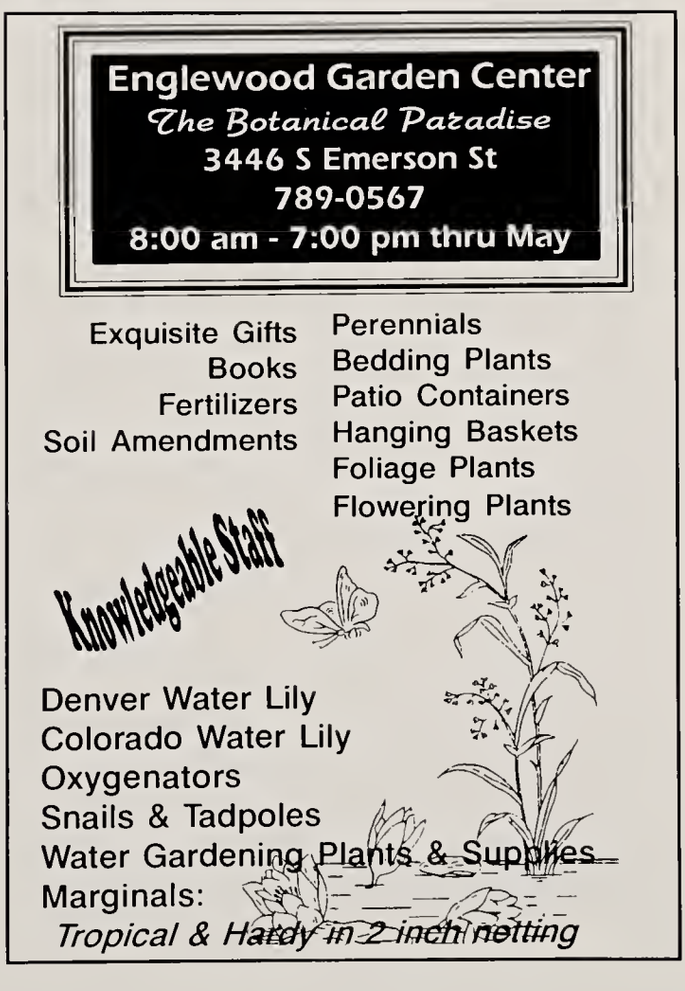
When repotting, plant the water lily with the crown submerged in the soil about one-half inch and firm the soil around the plant. Spread the roots as you plant to allow them a wider growth area. If they present a circular growth pattern, cut or tear them in three or four places around the root mass so they will establish a new growth pattern. Tilt the pot as you submerge it so the soil will not be disturbed. Allow about 1 1/2 inches of pot depth for gravel cover if you have fish.

Prune your plant back by removing the outer leaves to keep it compact and symmetrical for best display and flower production. Fertilize with two or three pond tabs every two to three weeks.

Autumn is the season when viviparous growths are produced. The growths are located at the point where the petiole joins the leaf blades and are evidenced by a "growth" or bump at that point. These growths are similar to the tubers produced beneath the soil, and each one will produce from one to several genetically identical plants. It is common for these growths to produce several plants that should be separated, if possible. Float these leaves in 75° to 80° F water until new leaves and roots develop (try floating them upside down). Then pot and grow the plants through the winter in bright light as you would tuber sprouts. In June plant in two-gallon pots and place in your pond to enjoy.

Soil is a very important factor in the culture of tropical water lilies. The ideal soil should be heavy and rich in nutrients. While clay often is recommended for water lily potting soil, keep in mind that the intent of the word "clay" means a soil that stays intact and in the pot. Clay itself is unsuitable and lacks the nutrition to support reasonable growth. Soil with too much fresh compost, loam, peat or matter that floats is too loose, and plants will separate from the soil and be lost.

Excellent tropicals to start with are: orange *Nymphaea* 'Albert Greenberg' (hybridizer: Birdsey), pink *N.* 'Pink Pearl' (hyb.: Koch), red *N.* 'Jack Wood' (hyb.: Wood), white *N.* 'Mrs. G. H. Pring' (hyb.: Pring), yellow *N.* 'St. Louis Gold' (hyb.: Pring), and blues and purples *N.* 'August Koch' (hyb.: Pring), *N.* 'Tina' (hyb.: Van Ness Gardens), *N.* 'Blue Bird' (hyb.: Tricker), *N.* 'Panama Pacific' (hyb.: Tricker) or *N.* 'Rhonda Kay' (hyb.: Landon).



Winterizing Your Pond

by Doris and Len Freestone

Enthusiastic water gardeners for 25 years in Colorado, Doris and Len Freestone started with one pond and now have three. They have volunteered at Denver Botanic Gardens' water gardens for the past 10 years and are members of the Colorado Water Garden Society. Their interests, besides water gardening, include traveling and photography.

Water lilies can be winterized in a deep stock tank. Photo: Joseph V. Tomocik.

Sadly, autumn comes around and it is now time to prepare your pond for the winter. Normally, in Colorado, a good time to do this is the first week in October. Start by removing all of the large leaves and dead flowers from your hardy water lilies. Do not remove the small new leaves as these are needed to start the new growth in the spring. Dividing and repotting the water lilies at this time will give them an early start and will save you time in the spring. Don't forget to re-label the new pots. Carefully lower the water lilies to the bottom of the pond, providing it is at least 2 feet deep. If your pond is less than the recommended depth, don't despair, there are other ways to winter over your hardy water lilies.

Alternatives include a cold basement, a root cellar or a cold garage. The temperature should be no higher than 50° F, but not below freezing. If you have a deep stock tank, remove the large pads and dead blooms, fill the tank with water and place the pots in the bottom. The water may need to be changed periodically throughout the winter to prevent it from stagnating.

If a tank of water is not practical, an alternative method is to pack the rhizomes in damp sphagnum peat moss. Be sure the peat moss does not contain any fertilizers. Remove the plant from the pot, wash off the soil and remove all roots and large pads, again leaving the new growth. Prepare the peat moss by adding water and mixing thoroughly. Test for moisture content by squeezing a handful of the moss; you should just barely be able to squeeze out water. Cover the bottom of a flat plant tray with about a 2-inch layer of moss and spread the clean rhizomes on the moss; they should not be touching each other. Pack more peat moss around and over the tops of each rhizome and cover with another tray. Do not forget to place labels in the tray or attach a label to each rhizome. Store trays at 45° to 50° F, cover with burlap sacking to help prevent drying out and do not let them freeze. Rhizomes stored by this method may be kept this way for a couple of years. Depending on the length of time and the humidity, you may need to add some moisture to the peat moss periodically. This method works very well if you are planning to move or build a new pond and you need extra time.

Yet another way to winter over your water lilies is to dig a hole in the garden, lower the pots and cover with soil and a good thick layer of mulch, such as leaves or pine needles. Or you

can store them in pots covered with bags of leaves outdoors.

Covering a small pond will help reduce freezing and also keep out trash, such as blowing leaves or pine needles. These materials sink to the bottom of the pond and decay, generating gasses that are toxic to your fish. A pond cover can be as simple as a piece of heavy plastic sheeting fastened to a wood frame. The frame should be strong enough to support the weight of the cover and heavy snowfall.

If you have fish in the pond you must keep a hole open in the ice to allow the gasses to escape. This can be accomplished by running a water pump under the water just deep enough to keep the surface moving. The pump should not be more than a few inches under the surface. If it is too deep it will bring the warm water up from the bottom of the pond. If the opening freezes over, use hot water or a drill to open the ice. Do not use a hammer! Hammering may harm your fish.

Dealing with hardy marginals and bog plants is quite simple—just leave them where

Another way to winterize water lilies is to store them in pots under bags of leaves or other mulch outdoors. Photo: Joseph V. Tomocik.

they are and trim off the foliage as it turns brown. If the pond is to be drained, bury the pots in the garden. Tropical bog plants must be brought indoors and may be used as houseplants by keeping them in a tray of water. Floating plants usually are discarded at the end of the season. If you have a heated greenhouse you may try keeping them in an aquarium.

Now that your pond is taken care of, like the plants you can hibernate until next spring, when you will be ready to once again enjoy the pleasures of your water garden.

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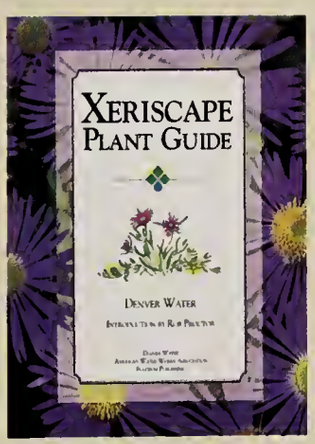

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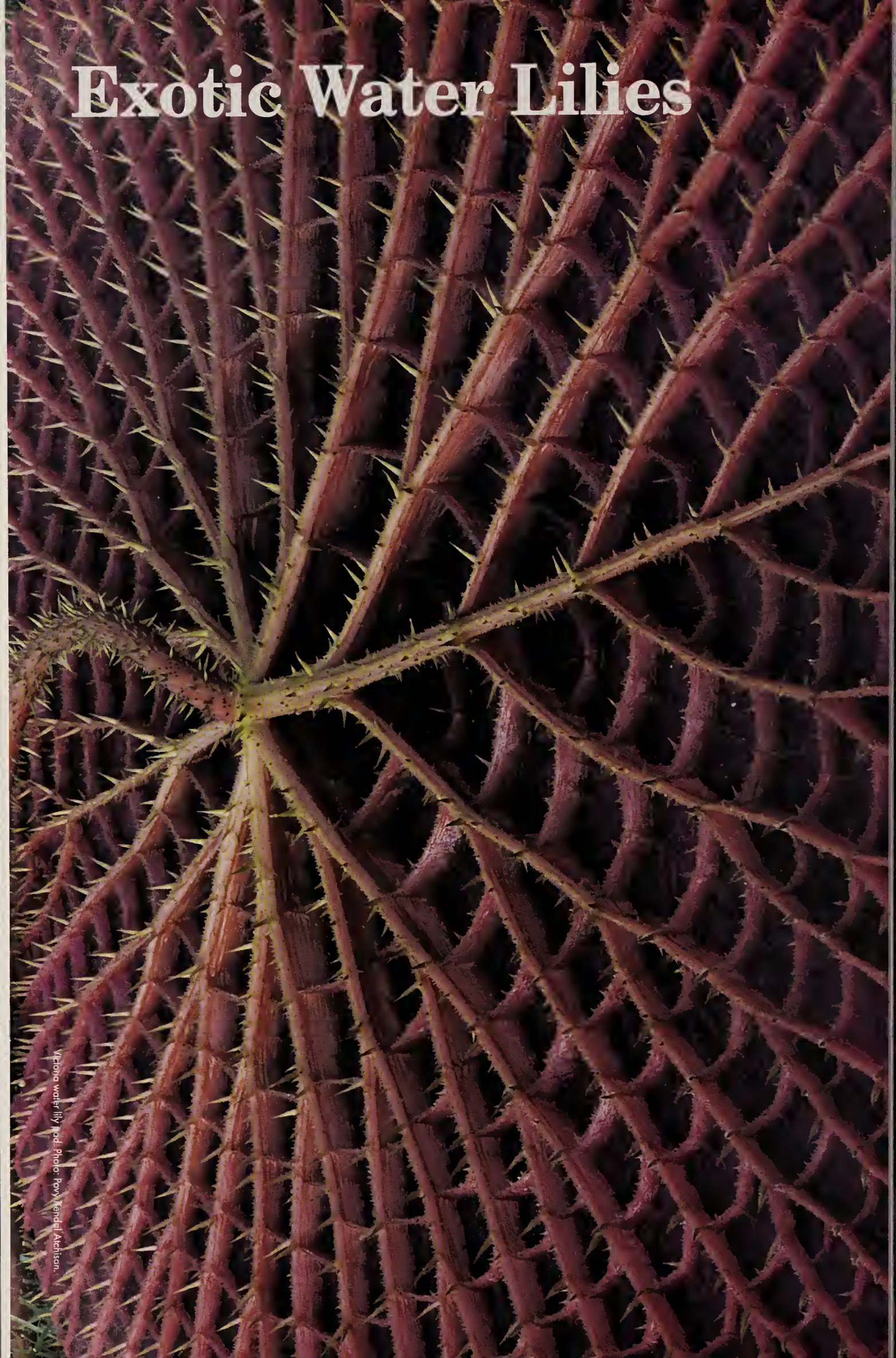
Exotic Water Lilies



Victoria water lily. Kod. Photo: Povy Kendall Atchison.

The Stately Lotus

by Stan Skinger

Nelumbo 'Perry's Giant Sunburst'. Photo: Joseph V. Tomocik.

Lotus are native to ponds and lakes and also grow along the margins of slow-moving streams and rivers. They range in size from miniatures only a foot tall, to plants taller than 6 feet. There are only two species of lotus, *Nelumbo nucifera* and *N. lutea*.

N. lutea is found in the eastern United States, Central America, the West Indies and Colombia. The color of the flowers is a sulfur yellow. *N. nucifera* is found in Australia, the Philippines, Asia, the Middle-East and Africa. The flower color is rose-pink, but there are varieties ranging in color from white to pink to red. Numerous varieties, cultivars and hybrids of the two species exist.

Lotus flowers range in size from 2- to 3-inch miniatures to blooms more than a foot in diameter. Many lotus blooms change colors, becoming darker or lighter as they mature during their three- to five-day life-span, and all produce seed pods that are popular for use in flower arrangements.

The lotus is grown as a staple food in Asia. Various foods are rolled in the leaves and steamed. The petioles are pickled or used with the flower petals in salads. The seeds are shelled and eaten like peanuts. The tuber is a component in many Asian dishes. The lotus has been worshipped in many cultures for centuries and often symbolizes longevity.

The genus *Nelumbo* is quite hardy (to USDA zone 5) and is aggressive in pond culture—it may take over the pond if not contained.

Lotus grow in a linear fashion, with a sequence of a tuber producing a leaf, perhaps a flower, then beginning another tuber to repeat

Nelumbo 'Empress'. Photo: Joseph V. Tomocik.

Lotus suggested for beginners include:

N. 'Empress',
white flowers with pink edges (hyb.: Slocum)

Nelumbo 'Momo Botan',
miniature pink and red flowers(hybridizer unknown)

N. 'Mrs. P. D. Slocum',
large pink and peach flowers (hyb.: Slocum)

N. 'Perry's Double Rose',
tall rose and red flowers (hyb.: Slocum)

N. 'Perry's Giant Sunburst',
large yellow flowers (hyb.: Slocum)

N. 'Tulip Lotus',
dwarf white flowers (hybridizer unknown)

the cycle—tuber, leaf, flower, tuber, leaf, flower, etc. Each terminal point produces a single leaf and a single flower (if we are fortunate) and then sends out the next growth.

Under the soil, the lotus growth takes two forms: runners and tubers. The summer "runner" form is thin and long (up to 24 inches) and has a diameter of three-eighths-inch to five-eighths-inch. The fall "tuber" form is thick and shorter (up to 10 inches) and can be 2 inches in diameter, tapering at the ends—similar in shape to a banana. When the term "tuber" is used hereon, it refers to the banana-shaped fall tuber and not the thin summer growth. With lotus plants, the most recent growth, called the "tip," is notoriously brittle and sensitive to breakage, and it is critical to the plant. Should it be broken or bruised, the lotus cannot grow and will die.

Due to the fragility of lotus roots and the necessary "banana" tuber form, lotus should only be divided in the early spring. In Colorado, this time is between the middle of March and the end of April, when the tubers are dormant—they quickly become unmanageable once they start growing. After that time, root growth has begun and the possibility of loss increases significantly. Generally, lotus also are shipped in March to mid-April when the tubers are dormant.

When you divide the plants or receive the tubers simply pot them up and sink them in your pond. In late spring, when you set up the pond, pull the container out temporarily or clean around it.

Lotus should arrive or be harvested with one or two complete tubers and the remainder of another. The entire tuber supporting the growing tip must not be harmed, but any preceding tubers may be trimmed away if necessary to allow the remainder to fit into the pot. To do so, trim the tuber about 2 inches away from the terminal of the retained growth. There does not appear to be a significant benefit in retaining extraneous second tubers, and they often prevent you from properly positioning the tuber in your pot. However, there is no harm in retaining these portions if your container is large enough to accommodate them, and they may provide for a quicker and stronger start.

To plant lotus, place the tuber with the cut portion against the container and the growing end pointing toward the center. Choose a container large enough to allow 4 to 6 inches from the end of the tip to the other side for growth. Barely cover the tuber with soil, one-half-inch, and hold it in position by placing a brick or rock over the tuber itself. The growing tip should just protrude from the soil.

Lotus conform to any shape when they grow. A square or rectangular container is OK, but lotus sometimes grow into the corner, deforming the tuber (rarely dying). Hence, round containers 16 to 24 inches in diameter or larger are ideal.

The soil for lotus, and any water garden plant, should be as rich as possible and heavy enough so it does not loosen or float. Pure clay does not provide the necessary nutrients for growth and should not be used. Even in the best of soils, lotus should be fed every three weeks. Two or three fertilizer tablets should be placed about 4 inches from the newest two or three leaves. A single tablet placed near the older leaves will assist in proper tuber production.

Lotus are invasive growers, and left unconfined they will take over a pond. It is important to grow them in containers without holes. I have observed "escape runners" reaching a length of more than 20 feet in a single season.

In general, the larger the container, the better the lotus will do. For optimal growth, the water depth over the soil should be 4 to 8 inches.

Lotus are sun-loving plants and will not do well with less than six hours of direct sun—more is better! Lotus will grow at 65°F and above, though ideal temperatures are 75° to 90° F. Denver's summer temperatures are adequate for lotus growth. Lotus are quite winter hardy if they are not frozen solid and may be over-wintered in the same manner as your hardy water lilies. A single tuber and tip will produce flowers the first summer under normal conditions.

Fish generally don't bother the plant itself. Their digging may be a problem, but if so, a cover of gravel over the soil will deter them.

Depending on the size of the container, lotus will need to be divided about every two years. Dividing too often may result in a plant that is trying to catch up, and waiting too long will inhibit growth and flowers. Lotus produce their tubers in a mass and tangle very easily. With a little experience, it is possible to tell the need for dividing and replanting by merely turning over the pot and looking at the root mass. If the mass is not overcrowded, slide a snow shovel under the soil ball and right the pot.

When it is time to divide lotus, the soil must be gently removed from the tubers, and the tubers should be separated in a manner to provide a "banana" tuber for each growing tip. A stream of hose water helps in the process. Again, be careful not to damage the tip. The thin "summer" tubers should be discarded, retaining only the "banana" type. Retain as much growth on the division as will fit into the pot.

Lotus are rather easy plants to sprout and grow from seed. The seed may be scarified (scratching the seed coat with a knife or file to permit more rapid absorption of water) if you wish. Experience indicates there is a slightly higher and quicker germination rate with scarification, but the end difference is not significant. If you have enough space and seed, try it both ways.

Using a rich soil, seeds should be planted about 1 to 1 1/2 inches under the soil, and the water temperature should be about 75° F to start. You can save some space by first floating the seeds in water in a plastic bag to sprout them.

The biggest obstacle is transplanting the seedlings into larger pots as they grow—seedlings, and especially the roots, do not take kindly to this process. A solution is to grow them in larger containers from the start. The containers should not have any holes in them since the lotus will exit the pot, thus ending your chances for success. The beginning container should be at least 8 inches in diameter—and again, larger is better. When potting up, do not disturb the tip or roots. Simply place the root ball, intact, within the next size pot and back-fill with soil.

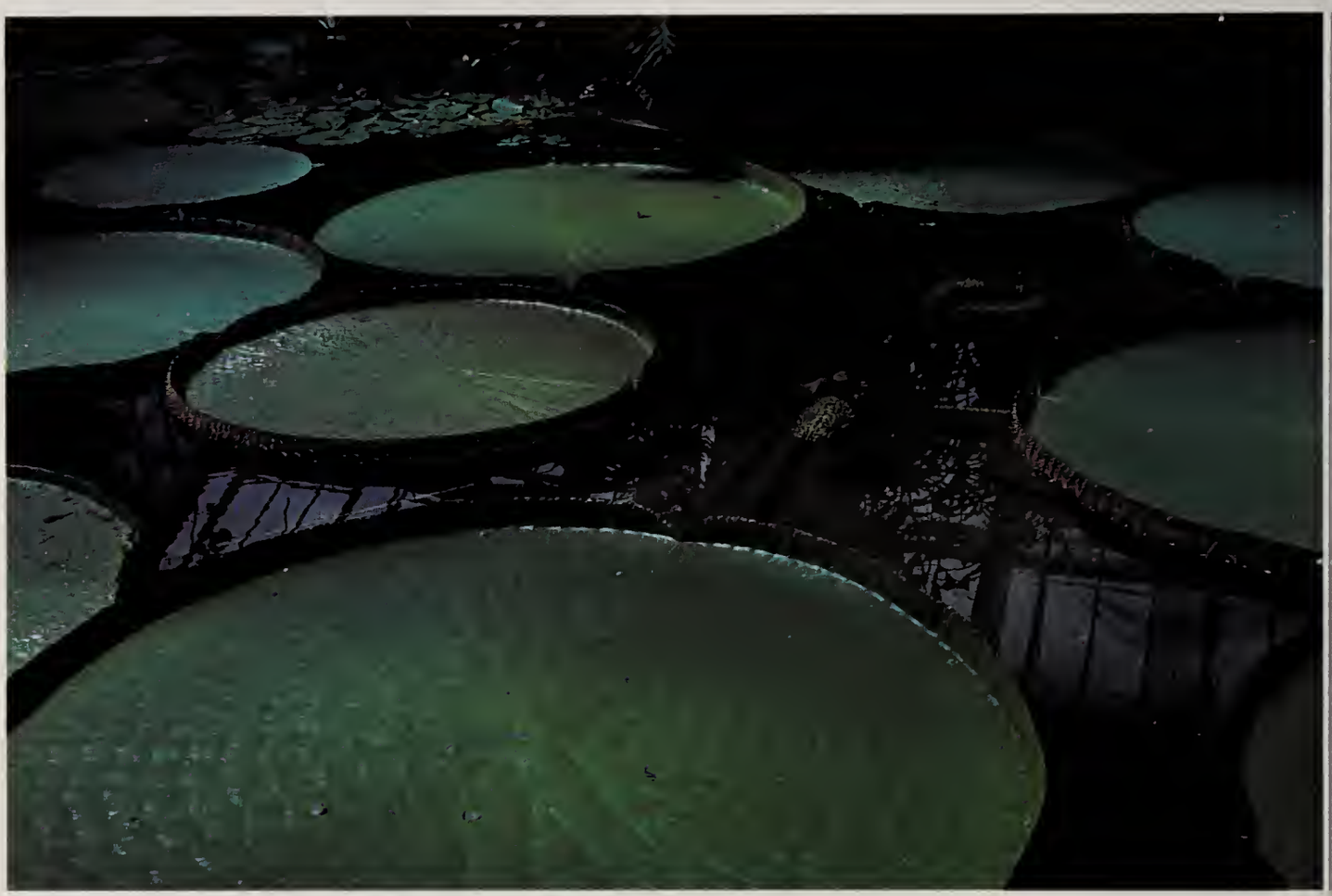
Lotus seeds are generally fertile if you cannot crush them with your fingernails. Some lotus seeds several hundred years old have germinated and grown on to bloom. I can't substantiate the reports indicating that seeds more than 2,000 years old, found in tombs in Egypt, have sprouted and grown. The best report I can rely on is a mere 700 years of age for some seed recently found in China.

Nelumbo at Denver Botanic Gardens. Photo: Denver Botanic Gardens.

The Queen Lily in the Queen City of the Plains

by Nancy and Trey Styler

Enthusiastic local water gardeners Nancy and Trey Styler are members of the Colorado Water Garden Society and the International Water Lily Society. Nancy is an Advanced Master Gardener and writes and lectures frequently on water gardening. She is the garden editor for Colorado Homes & Lifestyles Magazine. *The Stylers currently are involved with the Victoria Conservancy and grow the Victoria water lily in one of their backyard ponds, both for research and enjoyment.*



Victoria water lily pads of Princess of Wales Conservatory in Kew Gardens. Photo: Robert Meade.

"My astonishment and sensations cannot be described . . . there floating on the water were gigantic leaves, five to six feet in diameter . . . enclosed by a three to five inch high raised margin, bright green on the inside and on the outside bright carmine . . . there were luxuriant flowers with petals passing from pure white to rose."

These were the words of Robert Schomburgk in his 1837 description of the Victoria water lily, or giant Amazon water platter. You can have this same experience when you visit the Victoria display in the water lily ponds at Denver Botanic Gardens. Far from its tropical origins in South America, a fascinating plant with royal credentials blooms here in Colorado. This plant has a long history of enchanting those who encounter it.

Schomburgk didn't discover Victoria, of course. It was long known to the indigenous peoples of South America as a part of their culture and even their mythology. He wasn't even the first European to see Victoria. M.A. d'Orbigny had noted the giant water lily near Corrientes,

Argentina in 1927. However, Schomburgk was the first to formally report his find. He sent specimens and drawings of what he called "*Nymphaea victoria*" back to Dr. John Lindley in England, whose study established the plant to be a new genus within the Nymphaeaceae or water lily family. Dr. Lindley published a formal description in 1837 and proposed naming the plant *Victoria regia* in honor of his newly crowned queen. Later, the name was changed to *V. amazonica*, in accordance with the international rules of botanical nomenclature.

It is now understood that there are two species of Victoria. The plant described by Schomburgk is found in the equatorial Amazon River basin and is characterized by large reddish leaves with low rims. The plant described by d'Orbigny is the species found in the more southern (and cooler) Rio Paraná basin. Its leaves are a much brighter green, with 4-inch to 6-inch upturned lips. In 1840, this southern Victoria was named *V. cruziana* by d'Orbigny, in honor of General Santa Cruz of Bolivia. (This species was at one time called *V. amazonica* var. *trickeri.)* There is one other widely recognized variety of Victoria—in 1886, Edward S. Rand Jr. collected seed in Pará, Brazil which produced plants that were different from both *V. cruziana* and *V. regia*. It was called *V. regia* var. *randii* (and now is called *V. amazonica* var. *randii).*

In the meantime, a number of attempts were made to bring Victoria back to Europe. Seeds packed in wet clay germinated, but the seedlings died before maturity. Dry seeds and live plants were shipped back to England, but none lived. Finally, in 1849, Drs. Rodie and Luckie sent seeds from the Demerara River in British Guyana to Kew Gardens in bottles of fresh water, and these were successfully germinated.

Some young plants from Kew were distributed that year to Joseph Paxton, gardener to the Duke of Devonshire. Paxton had the advantage of using heated pools and the first modern greenhouse, which he had constructed at Chatsworth, the Duke's estate. Thus he was the first to bring *Victoria regia* into flower in England or Europe. In November 1849, Paxton presented a leaf and flower of the plant to Queen Victoria herself.

The flower of Victoria is quite magnificent. It can be up to a foot in diameter and is highly fragrant. Each flower opens only for two nights and changes color and sex in between. The leaves of this plant are equally impressive. The floating leaves, or pads, can grow up to 7 feet across and carpet the water in their natural habitat. Only a foot across when they reach the surface, the pads can expand as much as 8 inches in a single day. The mature leaf has an upraised edge, ranging from 1 to 6 inches in height. These pads can hold far more weight than their delicate surface would suggest, allowing birds to nest upon them. However, their smooth upper surfaces belie the thorny nature of their ribbed undersides. Strong hollow veins support this marvel of botanical structure, and sharp thorns cover the ribs densely to protect the thin leaf covering, as well as the flowers which emerge between the pads.

Paxton was inspired by this combination of strength and fragility and soon followed his horticultural success by applying the structural principles he found in the underside of the Victoria pad to the design of a new Lily House at Chatsworth. This was the first building to employ a rigid, self-supporting ribbed structure to hold glass panes, and it is the ancestor of both modern greenhouses and steel-and-glass skyscrapers. When Queen Victoria and her husband Prince Albert visited the Lily House at Chatsworth, they were so impressed that they commissioned Paxton to design and build a giant hall, using the same Victoria-inspired principles, for the Great Exhibition of 1851. Paxton said, "Nature was the engineer for the Crystal Palace."

This Exhibition Hall, though 1,851 feet long, was built in less than six months. It was made of glass panes no larger than 4 feet square, (the largest available at the time), set in wood and supported by steel ribs. These were made into larger sections that were assembled on the Hyde Park site. It became known as the Crystal Palace and was the first "pre-fabricated" building. Encompassing more than 770,000 square feet, it was considered the greatest manmade sight of the era. The hall contained many exhibits, among them a pool containing the Victoria water lily. This afforded the first opportunity for the general public to see this amazing plant

Violin player standing on Victoria pad at Missouri Botanical Garden in the 1890s. Photo: Missouri Botanical Garden.

in the building it inspired, and they, too, were fascinated. After just one year, the Crystal Palace was disassembled, moved across London and reassembled on Sydenham Hill, where it stood until destroyed by fire in 1936.

Once the trick of transporting viable seeds had been learned, the Victoria was brought quickly to North America as well. Warmer and longer American summers made Victoria somewhat easier to grow than it had been in England. The first flowers on this continent were produced near Philadelphia in 1851.

James Gurney was a young gardener for the Duke of Bedford in Woburn when Victoria first was brought back to England. Later in life, he became the head gardener at Missouri Botanical Garden in St. Louis. Soon a heated Victoria pool was constructed, and *Victoria amazonica* bloomed in St. Louis in 1894.

George Pring later took over at Missouri Botanical Garden and began the cultivation of *V. cruziana* there. Pring brought his plants and his expertise to Longwood Gardens in Kennett Square, Penn. There he met Patrick Nutt, who had been brought to Longwood from Kew Gardens to grow tropical water lilies. A heated protected pool was created for Victoria at Longwood Gardens, and this is where the two native Victoria species first were successfully crossed in 1960. The resulting plant, known as the *Victoria* 'Longwood', has a redder pigmentation, matures earlier and tolerates cooler temperatures and wind better than its parents. It can surpass both parents in flower and leaf size—an 8-foot, 6-inch diameter pad recently set the new world record for largest plant leaf at Kew Gardens' Princess of Wales Conservatory—making it an ideal plant for display.

The Victoria water lily now can be found in botanical gardens throughout the world, where it draws crowds today as it has since 1851. Artists and photographers have plied their art with the Victoria, and many people are familiar with turn-of-the-century photographs of babies and children resting on the pads.

Among the places Victoria holds court is, appropriately enough, here in the Queen City of the Plains, Denver. This queen of the water lilies occupies the center of the pools at Denver Botanic Gardens, where it has been grown each year since 1984. The strong Colorado sunshine and warm summer days allow the Victoria to grow and flower in the outdoor pools, amidst the rest of the Gardens' extensive water lily collection. Though Victoria can survive from year to year in its native waters or in a conservatory, here in Colorado it usually is grown as an annual and started from seed each spring.

Today, growers from around the world are establishing the Victoria Conservancy, an organization dedicated to the preservation and study of existing forms of cultivated species of the Victoria. Major goals are to diversify the gene pool by out-crossing and seed importation and to establish a breeding program to offset the effects of years of inbreeding. Another research program involves DNA analysis in an attempt to trace the lineage of Victoria and the other Nymphaeaceae.

The Victoria Conservancy hopes to ensure that Victorias will continue to be grown and displayed in backyards and botanical gardens around the world, fascinating and inspiring us as they have for the last 200 years. If you would like more information about the Victoria water lily, please contact the Victoria Conservancy, 6583 East Ida Avenue, Greenwood Village, CO 80111.

High Plains Horticulture of the Victoria Water Lily

by Nancy and Trey Styler

The Victoria water lily can be successfully grown, even here in Colorado. Each year since 1984, under the direction of Joe Tomocik, aquatic horticulturist at Denver Botanic Gardens, Victoria has been the centerpiece of the extensive aquatic displays. Despite its requirements for large warm ponds, tender loving care and huge amounts of fertilizer, this outrageous plant has inspired even home gardeners to try their hand at growing it. Even this most exotic of the tropical water lilies can thrive here, given the right conditions.

Victoria is a genus in the Nymphaeaceae, water lily family, a cousin to the *Nymphaea* and *Nuphar* genera which contain the other water lilies. There are two distinct species of Victoria native to the flood plains of the two main river basins of South America. *V. amazonica* is found in the warmer equatorial waters of the Amazon River basin. It has large, 5-foot to 7-foot diameter leaves with low rims, three-quarters to 2 inches, and a reddish-green pigmentation. *V. cruziana* thrives in the somewhat cooler waters of the Rio Paraná basin to the south and has smaller (4-foot to 6-foot diameter) bright green pads with tall rims, 6 to 8 inches high. In the wild, these two species are not thought to intermix, due to their different ranges and temperature preferences. (A natural hybrid may exist in the Matto Grosso region of Brazil, where the tributaries of the Amazon and Paraná rivers interlace, but this has not been confirmed.)

The two native Victoria species first were successfully crossed in 1960 by Patrick Nutt of Longwood Gardens in conjunction with George Pring of Missouri Botanical Garden. They used pollen from *V. amazonica*, with *V. cruziana* as the receptive, seed-bearing parent. The resulting plant, known as *Victoria* 'Longwood', has a redder pigmentation, matures sooner and tolerates cooler temperatures and wind better than its parents. It can surpass both parents in flower and leaf size, and it is therefore the most popular Victoria for exhibit. However, the original cross must be repeated to produce new *V.* 'Longwood' seeds.

On first glance, the most striking thing about Victoria is its characteristic large leaves with upturned edges. A mature leaf is quite buoyant and can support 150 to 200 pounds, if properly distributed. Closer inspection shows that these smooth-surfaced pads are supported underneath by a branching structure of strong hollow ribs, which intersect and form small pockets. And there are thorns. Every surface of Victoria except the top of the leaf is covered with thorns up to an inch long, strong enough to puncture a glove or wader with ease.

But the most fascinating characteristics of the Victoria are its marvelous flower and the mutually dependent relationship it has with the scarab beetle.

After the plant matures and a number of pads have been produced, it will begin to bring forth a series of flowers, each of which lasts only 48 hours. Since Victoria is a night-blooming plant, the show begins at sunset, triggered by falling light levels. A tennis-ball-sized bud opens into a 9-inch to 12-inch creamy white flower which rests on the surface of the water. As the bud opens, an intense pineapple-like fragrance is released, designed to attract pollinating insects. This scent is perceptible even to humans at distances of 20 to 30 feet. The flower temperature actually rises as much as 20° F as it opens, disseminating the fragrance and providing a warm place for a hungry insect to spend the night.

1) *Victaria cruziana* white fragrant flower the first evening.

2) *V. cruziana* reddish-purple flower the secand evening

3) *V. cruziana* flower the third evening.

Photos: Nancy Styler.

Victorias are protogynous: On the first night, the flower is receptive, or female, awaiting pollination. When it re-opens on the second night, the petals have become a reddish-purple color and the pollen is now mature. The flower is now male, capable of pollination but no longer receptive. This decreases the chances of self-pollination.

The main pollinator of the Victoria is the inch-long scarab beetle (*Cyclocephala hardyi*), which is attracted by the brightness, fragrance and heat of this regal white bloom. Entering the partially opened flower, the beetle, which is hopefully covered with pollen from another flower, works its way into the cavity at the base of the blossom. Here, a starchy substance inside provides a wonderful meal for the beetle, who spends the night in this aromatic, warm environment. It is so nice, in fact, that often several beetles will crowd into the same flower. Meanwhile, a sticky fluid at the flower's base traps the pollen brought in on the beetle, and pollination occurs.

Later, the flower temperature drops to normal, the fragrance dissipates and the innermost ring of petals begins to turn pink. With dawn approaching, the bloom begins to close, trapping the scarab beetle inside. When it opens on the second evening (slightly earlier than a first-day flower, and quite pink or red by now), the beetles that had been trapped overnight have their chance to escape by pushing their sticky bodies past the now-ripe pollen-laden anthers and out of the flower. These pollen-covered insects fly off in search of another bright, white, first-night bloom to repeat the cycle.

Since there are no scarab beetles in Colorado, if pollination is to occur, it must be done artificially. The process, as taught by Pat Nutt and Tim Jennings of Longwood Gardens, is to remove the pollen-bearing anthers from a second-day flower, and place one or more of them into the center of a freshly opened first-day flower. One can then use a small brush or swab to distribute the pollen around the inside surface to enhance the pollination rate. In making controlled crosses, it is important to remove the immature anthers of the receiving flower to prevent self-pollination, and then to cover the pollinated flower with cheesecloth or the like to prevent accidental pollination by local insects.

Victoria 'Longwood' seeds. Photo: Povy Kendal Aichison.

If pollination is successful, the spent flower, still attached to its thorny stalk, will sink into the water for the six weeks needed for the seeds to mature. Here in Colorado, this means it will be September or October before seeds are ripe, so the water will probably require a cover or some supplemental heat. The seed pod can grow to the size of a baby's head and also is covered with thorns (possibly to ward off rodents, who are particularly fond of these seeds). When fully ripened, the pod will "explode," releasing the mature seeds. The seeds are covered with a gelatinous material called an aril. In the wild, this allows them to float along with a current until, eventually, the seeds sink to the bottom, starting a new plant if conditions are right. Wide dispersal of plants occurs in this manner, as each seed pod can contain hundreds of pea-sized seeds. These nutritious seeds, called water corn by the natives, are collected and ground into a farina or flour to make a cake which is a delicacy and a luxury to the South American Indians. In cultivation, each ripening seedpod is covered with a cheesecloth bag to ensure that any seed produced is captured.

To bring Victoria into bloom in Colorado before frost, seeds should be sown in late February. Seeds can be germinated in water or planted into small pots of heavy soil and covered with 2 to 4 inches of water. *V. cruziana* is germinated at water temperatures of 72° to 75° F, while *V. amazonica* and *V.* 'Longwood' do better at 82° to 85° F. The seedlings are moved into progressively larger pots with richer soil and deeper water as they grow. It must be noted that Victorias appear quite sensitive to salt and chemicals such as chlorine, chloramines or heavy metals, so water treatment may be necessary. It usually requires three to four months before the plants are ready to be put outdoors, but Colorado ponds probably won't have the needed 75° F temperatures much before the end of June anyway.

At this stage, that unassuming seedling has become a plant with pads 8 to 10 inches in diameter in an 8-inch to 10-inch pot and covers some 5 or 6 square feet of water surface. Soon, however, the mature plant will need a 25-gallon to 50-gallon pot, 2 to 4 feet of water depth and at least 100 square feet of pond surface area. If this can be provided, along with several pounds of fertilizer a week, Victoria usually will thrive. Here in Colorado, there are none of its natural predators (or pollinators), though local insects seem to enjoy life on the pads. Its biggest natural enemies, so to speak, are our cool nights, early frost and the occasional hailstorm.

With good growing conditions, flowers begin to appear by August and will continue to bloom as long as it stays warm. Although Victoria can be a perennial in its native habitat or in a conservatory, in Colorado it will fade with the cool fall nights and die completely with the first hard freeze. If ripe seeds have been produced, they should be stored in water at 50° to 60° F until it is time to germinate next year's crop.

So, when you see Victoria on display at Denver Botanic Gardens, you can appreciate the journey that has brought it here and the efforts that turned a small South American seed into an incredible Colorado plant.

Special Considerations: Fish, Aquariums and Algae

Koi [*Cyprinus carpio*]. Photo: Roland D. Cameron.

Fish and Water Gardening

by Roland (Ron) D. Cameron

Ron Cameron is owner of Ron's Golden Ponds in Lakewood, Colorado. He is a member of the Rocky Mountain Koi Club, Colorado Water Garden Society and International Water Lily Society. He has been building ponds and filtration systems and has worked with aquatic plants and fish for more than 30 years.

The pond is so magnificent, its rich colors and vibrant textures; the sound as soft and gentle as a light breeze or vibrant and churning as all nature's fury. What more could you ask for in this aesthetic wonderland? Fish, of course. Their rich colors and graceful movement provide an additional dimension to the pond, from the simplest common goldfish to the most magnificent koi. Fish can calm the most nervous viewer, and their antics can make almost anyone smile.

Goldfish

Almost everyone is familiar with the common goldfish (*Carassius auratus*). As pets, they date back to the Chin Dynasty (265 to 420 A.D.) in their original red form, and by 1200 A.D. they had been bred to include silver, black, gold and even mottled colors. They are hardy fish and can be kept in the simplest garden pond or small tub garden. They require only sufficient surface contact with air to provide them with oxygen, and if plants are present, their food will be provided by nature.

When the weather gets hot, it is best to provide additional oxygenation with a fountain, waterfall or air stone. In winter a small area should be kept ice-free to provide an escape area for gases that build up in the water.

Goldfish will certainly breed in almost all conditions, and it is interesting to watch the small ones grow up. The quick rate of growth and reproduction can result in an unexpected explosion of numbers in a very short time and cause some problems with overpopulation and poor health. Some larger varieties of goldfish can grow 8 to 10 inches and can live approximately 10 to 20 years.

Goldfish eat insects, plants and their own eggs; they also enjoy bread, corn, peas and commercially manufactured foods. You may feed your fish six or seven times per day, but only feed the amount of food the fish eat in a few minutes or you will pollute the water. Goldfish will pick up stones and soil with their mouths from your potted plants in search of insect life and algae, but they do not always place the soil back in the pot. Place rocks on top of the soil to minimize this problem. Nylon netting also can be placed over the top of pots to discourage fish from removing the soil.

Some breeds of goldfish, such as oranda, lionhead, pompon and bubble-eye, are pretty but are very slow swimming, and therefore, not always a good choice for outdoor settings due to the presence of predators. Some of the better choices are comet-tailed, common, jikin, shubunkin, calico, ryukin and black moor.

Koi

Koi (*Cyprinus carpio*), as they are called in America, originally came to China and Japan more than a thousand years ago as a food product. They were first bred for color in Ojiya, Japan in 1820. Breeding of the red mutations produced Kohaku (red on white) koi by 1870. Now there are many varieties, each with its own distinctive pattern and color. Koi can live 70 to 90 years in captivity and can grow larger than 36 inches over this period. Koi are hardy fish and can withstand severe conditions, but because of their size, they need to have a good amount of oxygen in the water. Use care in the number of koi you put in your pond—they grow quickly. Koi are trained easily to come for food and can be taught to eat from your hand in a short time.

They come in all colors of the rainbow, some with metallic hues, some with scales like diamond dust, some with long flowing fins and tails. Koi are a sure hit in any pond and can add many hours of pleasure to your pond experience.

Koi are bottom feeders—this can cause some problems. If they are not fed enough they may remove rocks and soil from your potted plants in search of food, sometimes leaving the pot void of all but the plant's roots. To keep this from happening, put rough stones on the top of the soil in your potted plants. Another way to discourage digging is to put polyester batting over the soil in your pots and tuck it in around the edges. There are commercial products that have no soil in them. They consist of compressed coconut fiber within a nylon bag. The fiber is rolled within the bag and the water lily is planted within this roll, with its crown at the top and the bag tied around the crown. If a fertilizing lily tab or two are added when the water lily tuber is planted the roots soon grow into the coconut fiber. After it is obvious that the roots are into the fiber, untie the bag and pull the top down the sides a bit. This will allow the rhizome to naturally grow across the top. You will have to fertilize a little more with the soilless planting medium since there is no soil to provide nutrients. As with goldfish, you can try using nylon netting (large holes, 5/8-inch) so the water lily leaves can grow through. Leave the netting a little loose, not tight on the crown or soil.

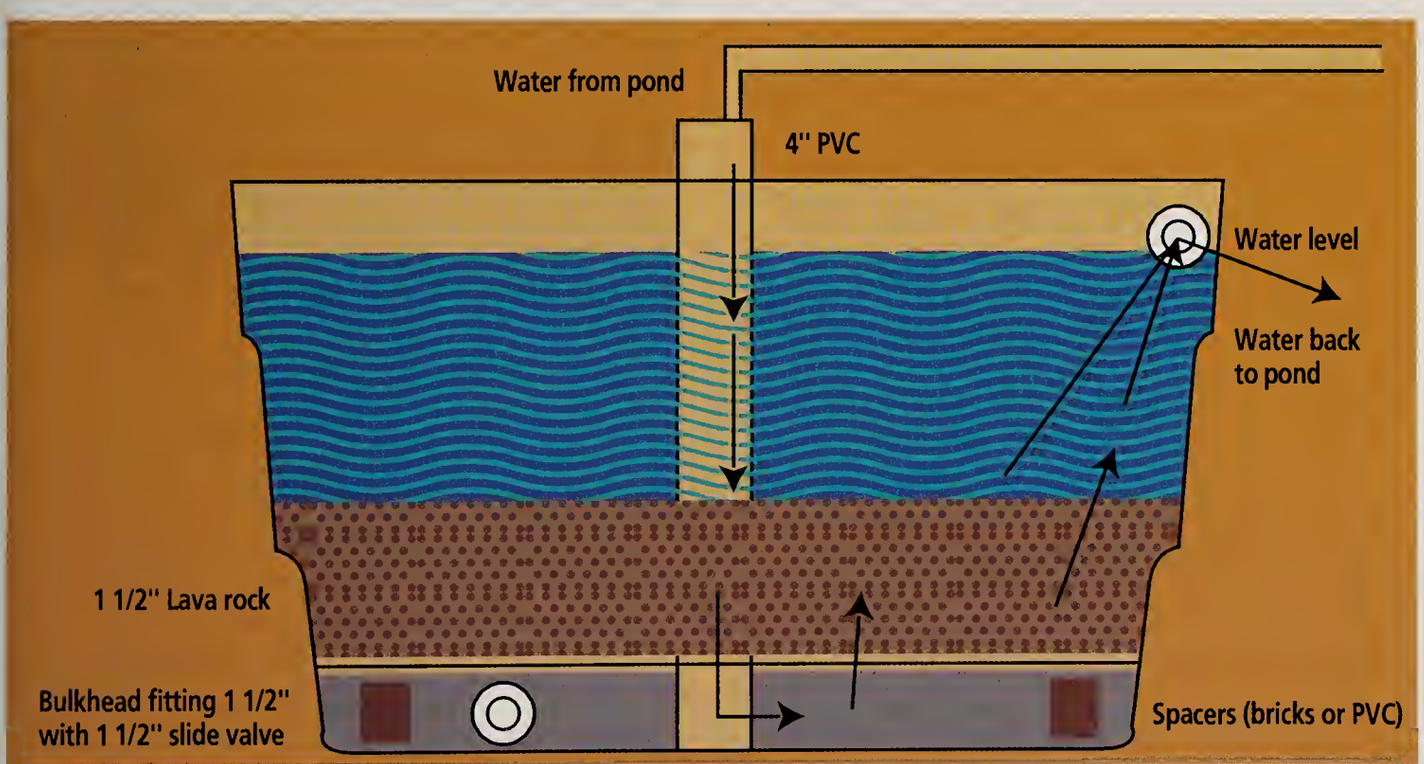
Grass Carp

Grass carp (*Ctenopharyngodon idella*) are a hotly debated addition to the garden pond. They have been put into ponds on golf courses for years to control weeds and are very effective. In the garden pond they are effectively used to eliminate many kinds of filamentous algae. However, as with all life on earth, they will not starve willingly if a food source, such as your water lilies, is available. I have placed grass carp (only one per pond) in many ponds and have found that they do not cause any greater problem than koi or goldfish. Keep in mind that they will not starve and you will not be able to catch them, short of draining your pond.

Golden Orfe

Golden orfe (*Leucisus idus*) are another variety of fish from the Cyprinidae family found in many ponds. They can grow up to 24 inches and are very fast-swimming fish. They are predatory by nature and may injure other fish, though they can be kept with other species. Golden orfe are an attractive red-orange color and are shaped somewhat like a trout. They eat insects and fish food and are found naturally in many European countries.

No one should tell you about fish without telling you how to keep them healthy. With any species of fish you need to provide "healthy water" for them. Clear water is not always good water;


Water from pond
4" PVC
Water level
Water back to pond
1 1/2" Lava rock
Bulkhead fitting 1 1/2" with 1 1/2" slide valve
Spacers (bricks or PVC)

Biological filter system. Illustration: Toil Catcher Design (adapted from Roland Comeron).

buy an ammonia test kit and use it. Ammonia is a by-product of fish waste and the decomposition of plants in the pond. This ammonia is what usually causes fish to get sick and die. It also is one of the primary causes of "green water" (the presence of large numbers of microscopic free-swimming algae). Ammonia is broken down naturally by the bacteria in your pond into nitrite and then nitrate. Ponds usually contain more ammonia than the beneficial bacteria present in the pond can break down. The solution is to install a system that provides more surface area for the bacteria to colonize and hence, break down the ammonia—a biological filter system. It is not as technical as it sounds. A filtration system mechanically removes any debris floating in the water and acts as a chemical or biological system for eliminating toxic materials.

Many companies build good commercial filter systems for all sizes of ponds, and if you are a little handy, so can you. When determining the size of your filter system, consider the amount of fish waste and plant material that must be eliminated from the system. No quick and easy formula will fit every situation, but any filtration usually is better than none. Test the water in your pond with a test kit, ask people who have successful ponds or check with a professional in the filtration business for advice on filtration system size.

The water from your pond enters the bottom of a watertight container, such as a plastic barrel, plastic stock tank or large planter, through a hose or tube. The container should have a 1 1/2-inch wall fitting (depending on the size of your filter) near the bottom of the container, with a valve to allow periodic removal of sediment from the container. The top of the container also should have a wall fitting and pipe to allow the clean, filtered water back into the pond. The bottom of this container holds only the water and a few bricks or short pieces of plastic pipe to support a grid.

The grid can be a sheet of rigid plastic with lots of holes drilled through it, or any plastic material that will hold up a large amount of gravel or other media and let the water pass through. The grid should fit close enough to the sides to not allow the media to fall into the bottom of the container. The container can be filled with 1 1/2 inches of lava rock, hair rollers, drinking straws, plastic forks or any type of commercial filter media. If your media floats you will need to put something on it to hold it down. The beneficial bacteria will colonize the media and keep your pond and fish healthy. Remember that you are filtering the fish and plant waste, not just the water. You need more filtration than your pond provides naturally only if there is a reason for it. If you have green water, sick fish, smelly water or high ammonia (above 0.2 milligrams per liter)—filter! Always treat your water for chloramine when adding water to your pond or container to avoid injuring the gills of your fish and possibly causing their death.

Don't put in too many fish. Remember that they grow, and in the case of goldfish, they reproduce quite rapidly. A good rule of thumb is to provide 48 square inches of surface area per inch of fish. If you want to have healthy fish in large numbers, filter your pond, maintain aeration and, most importantly, enjoy them.

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Aquarium Displays: Water Gardening for the Living Room

by Paul R. Martin

Paul Martin has been keeping aquariums and aquatic plants on and off since he was a teenager. Several years ago he began volunteering for Denver Botanic Gardens' aquatic horticulturist Joe Tomocik and helped to enlarge the collection of aquatic plants, especially "marginals," at the Gardens. He is a botanical artist who has studied in Denver Botanic Gardens' and CU Denver's Botanical Illustration classes.

The maintenance involved dissuades many from keeping aquariums. Besides the weekly water change there is usually the daily fish-feeding ritual, not to mention chores involved in keeping plants and suppressing the growth of algae. One might well ask "why bother?" until one happens upon an example that speaks for itself.

During the last 30 years, European hobbyists, particularly the Dutch and Germans, have raised this widely known but little-respected arena of horticulture to the level of an art form. Because it's primarily a phenomenon of private spaces, one doesn't often see evidence of it outside specialist (aquarium hobbyist) publications. Public aquariums sometimes rise to the occasion, but the scale of these exhibits generally discourages imitating them in one's living room.

One modern innovation that has fueled interest in heavily planted aquariums is the development of carbon dioxide (CO_2) injection and the CO_2 controller. By making carbon dioxide more available, many plants that require bright light—species that could barely be maintained in aquariums before the use of this technological assist—can be grown well. The CO_2 controller controls pH by dispensing gaseous CO_2 in the form of tiny bubbles that are readily absorbed into the water. Some of the absorbed carbon dioxide becomes carbonic acid, reducing water pH. This acidity buffers the water's carbonate hardness. "Free" CO_2 also is made readily available to the submerged plants, many of which cannot utilize other forms of dissolved carbon dioxide, such as carbonates.

Why supply a gas that is so plentiful in the air we breath? Water absorbs this gas from the air quite slowly. (Paul Kromholtz, "Carbon Dioxide and Aquarium Plants," *The Aquatic Gardener*, vol. 4, nos. 3 & 4, 1991.) Aeration of the water does nothing to alleviate this shortage; in fact, it exacerbates the problem. When plants that needed more light were grown, and light sources were used that could meet these plants' needs, it was discovered that the pH of the water in a densely planted aquarium tended to rise during the day, indicating a shortage of carbon dioxide and an increased rate of photosynthesis. By supplying a small amount of additional carbon dioxide, the pH of the aquarium water could be stabilized, and many species of aquatic plants that require bright light could successfully be cultivated.

While the development of carbon dioxide injection and the CO_2 controller is one of the most significant developments in modern aquarium displays, it is by no means the only one, nor does it solve all the problems of keeping a large number of plants in a small body of water. There are several trace elements required by plants that are not adequately supplied by tap water (or by fish wastes), and trace element mixtures have been formulated to supply these elements commonly in short supply. Iron is the major trace element in these formulations.

Some plants, notably a water lily relative sometimes called the orchid lily (*Barclaya longifolia*), grow much better with a root zone warmer than the surrounding water. A low-voltage heating cable was devised (similar to the kind used to warm outdoor seedbeds and frames) that could

Photo: George and Karla Booth.

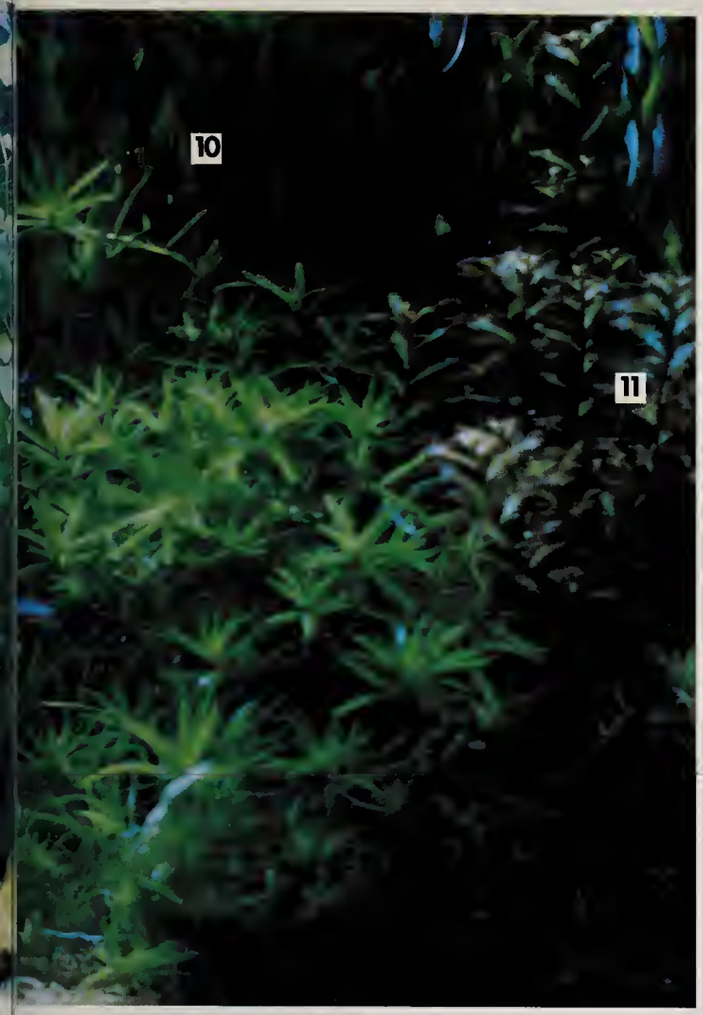
be safely immersed and would effectively cause water and nutrients to move through a substrate composed of 2- to 3-millimeter diameter gravel. A result of this slow-heating induced water movement is the avoidance of stagnation and anaerobic decomposition (with its accompanying hydrogen sulfide or "swamp" gas). Anaerobic decomposition of organic matter is a well-known hazard of aquarium substrates that are more than an inch in depth and have no water moving through them.

Clays of various kinds have long been a recommended substrate additive. Laterite clay of tropical origins recently has become available and can be mixed with the bottom third of the gravel. It supplies important minerals for rooted plants and, when used in conjunction with under-gravel heating cables, binds up dissolved nutrients, making them more available to roots. This type of clay does not alter water chemistry, making the water harder, as would most clays from temperate regions.

Filters also have changed, with the development of "canister" and "trickle" models featuring increased water flow. The trickle type is well-suited to accomplish biological filtration (bacteria metabolize nitrogenous wastes into less toxic metabolites), required by large numbers of fish in an aquarium. Both fish and plants benefit from good water circulation, that disperses nutrients and helps to disperse and recycle wastes. Fish wastes are valuable food for plants (including algae), but periodic water changes of 20 to 50 percent still are necessary to maintain favorable water quality for both fish and plants.

The results of these recent innovations in aquarium-keeping are very persuasive to those who have witnessed them first-hand. Some plants grow more than twice as fast as they had been known to grow before CO_2 injection. Many fish also show color intensities only previously glimpsed in the wild. Besides serving as a showcase for naturalistically arranged vigorous aquatic plants, part of the appeal of an aquarium of this kind is the quality of reflected and transmitted light that spills from it into the surrounding space.

Controlling algae is a concern of pond-keepers and aquarium hobbyists, and the solution is much the same for the pond as for the aquarium: regular maintenance is needed to help stabilize water quality and promote healthy vascular plant growth. Given the algae-promoting



reputation of phosphates, the control of these compounds is of particular concern, and there are easy-to-use test kits that quickly read phosphate concentrations. Algicides can be useful in certain special situations, but they are rarely advisable in a heavily planted aquarium because they retard desirable plant growth in addition to killing the algae. Fish also have been called upon to tip the balance in favor of vascular plants—the Siamese flying fox (*Crossocheilus siamensis*) is the most effective in removing algae from plants—but no fish can be expected to stem the tide of a serious "outbreak." Here, as in other areas, "an ounce of prevention is worth a pound of cure."

Regular feeding of the fish in an aquarium not only benefits the fish, but also supplies nutrients to the beneficial bacteria and plants alike. Beneficial bacteria compete with plants for ammonium, a part of raw fish wastes. Plants are able to use the nitrate end product of the bacterial degradation of ammonium, though with a greater expenditure of energy. (Diana Walstad, "Nitrification in the Planted Aquarium," *The Aquatic Gardener*, vol. 6, no. 1, 1993.) Unless one wishes to replace fish with a regime of inorganic fertilization, one learns, as I am now with

Plants identified in the photo at left:

1. Creeping Jenny or moneywort (*Lysimachia nummularia*)
2. Red Amazon sword plant (*Echinodorus osiris*)
3. *Anubias* sp.
4. Java fern (*Microsorium pteropus*)
5. Brazilian pennywort (*Hydrocotyle lencocephala*)
6. Madagascar lace plant (*Aponogeton madagascariensis*)
7. Dwarf sagittaria or dwarf arrowhead (*Sagittaria subulata*)
8. *Lilaeopsis* sp.
9. Brazilian stargrass (*Heteranthera zosterifolia*)
10. Straight vallisneria (*Vallisneria spiralis*)
11. Creeping ludwigia (*Ludwigia repens*)

Plants for moderate light levels:

African fern (*Bolbitis huedelotii*)
(attaches itself to wood and stone)

Aponogeton undulatus hybrids

Cryptocoryne affinis

Cryptocoryne beckettii

Cryptocoryne wendtii

Dwarf anubias (*Anubias barteri* var. *nana*)

Dwarf rotala (*Rotala rotundifolia*)

Floating water sprite (*Ceratopteris pteridioides*)

Java fern (*Microsorium pteropus*)
(attaches itself to wood or stone)

Java moss (*Vesicularia dubyana*)

Plants for high-intensity or bright light levels:

Alternanthera sessilis

Cryptocoryne ciliata

Cryptocoryne crispatula

Dwarf rotala (*Rotala rotundifolia*)
(more colorful in stronger light)

Giant bacopa (*Bacopa caroliniana*)

Giant red rotala (*Rotala macrandra*)

Orchid lily (*Barclaya longifolia*)
(especially the reddish-leaved form)

Red ammania (*Ammania senegalensis*)

Texas mud baby (*Echinodorus cordifolius*)

Water cabbage (*Samolus parviflorus*)

Water wisteria (*Hygrophila difformis*)
(syn. *Synnema triflorum*)

Willow-leaf hygrophila (*Hygrophila salicifolia*)

the aquarium at Denver Botanic Gardens' Morrison Horticultural Demonstration Center, that too few fish is as troublesome a situation as too many fish. Algae growth often results from both situations.

So how many fish are too many? Of course, any fish is "too many" if it eats or uproots plants, or if it grows too large. The commonly cited rule is no more than one "fish inch" per gallon, but that's just a rough guide. Remember that a large fish will make the aquarium appear smaller, while a small fish will make it look larger. In any case, only a few fish should be added when the aquarium is first set up (preferably algae eaters), before the beneficial bacteria have established themselves. But now we are wandering into the province of your local aquarium dealer or fish-keeper. The most important thing to remember when setting up a heavily planted aquarium is the need to start out with lots of healthy, fast-growing, adaptable plants, and to get them off to a vigorous start before algae can become established. Later, when the water chemistry has become more stable, often in three or four months, one can replace some of these fast-growing plants with slower-growing, more sensitive kinds such as *Cryptocoryne* species.

Although modern developments have greatly increased the chances of establishing an effective display, they haven't done much to reduce the time required to maintain it. Every week a few hours should be set aside for maintenance, a large part of which will probably be spent cutting back and replanting plants, particularly the faster-growing ones. If you don't have time to spend on these simple chores, the aquarium can soon become an overgrown mess. For those with the time and inclination, however, it can be a delightful, absorbing hobby that is very stimulating to the visual imagination, and very evocative as a part of the natural world few of us see much of: slow moving tropical streams and wetlands.

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Algae Control

by L.C. Keenan

L.C. Keenan is a retired U.S. Department of Agriculture biologist and entomologist. He was one of six USDA professionals assigned to initiate Integrated Pest Management (IPM) strategies to address the pesticide misuse problems in the 1960s. After many years of field experience, Keenan is utilizing some of the same proven IPM concepts in his pond and lake water quality management business, Quality-Water BioSystems Inc., in Broomfield, Colorado.

If you have ever cared for any small backyard pond, you probably have experience with some kind of undesirable algae or other aquatic vegetation. Before we get into how to control or manage perplexing algae problems, let's take a look at some of the basic aquatic ecology that is taking place in your pond.

We first need to ask the question, "What are algae?" Many people look at the various kinds of aquatic plants common in a pond and refer to them as algae, moss, seaweed, scum and other uncomplimentary names. The fact is, many aquatic plants are not algae, but are true vascular plants. Algae are simple, primitive, aquatic plants common to virtually all small ponds, everywhere. Algae differ from other plants by lacking true stems, leaves or roots. In natural settings, algae are a basic component of a complex aquatic food web, converting the sun's energy into a form useful to many other kinds of aquatic life. Algae also can be a primary source of dissolved oxygen in water. Oxygen is a byproduct of algae energy production (photosynthesis). Dissolved oxygen in the water column is critically important to a variety of organisms, from tiny microbes to large fish.

Algae occur in three basic forms: planktonic, from the Greek word *planktos*, meaning drifting; filamentous, describing long, thin threads or filaments; and macrophytic, which appear to be true plants.

Planktonic algae are usually tiny, single-celled, nearly microscopic plants floating or drifting freely in the water. When these tiny plants become extremely abundant, and they commonly do, we refer to the situation as an algae "bloom." Planktonic algae can give the water a greenish pea-soup color. Less often, they can turn the water other colors, including red, brown or yellow. Some planktonic algae species can be toxic and have a very undesirable odor.

Filamentous algae often are referred to as "pond moss" or "pond scum." Filamentous algae growth occurs as fine green strands starting along the edge of the pond or clinging to submerged structures, such as plants, rocks, sticks or other objects. As the filaments grow and become aged, they develop air inside their cells and float to the surface as mats. The mats can accumulate over large areas, drifting around the surface of the pond as they are pushed along by the wind. Filamentous algae are probably the most pesky form of algae in small, nutrient rich ponds.

Macrophytic algae resemble true plants—they appear to have true stems and leaves, and some species are attached to the bottom. Kelp, as in the famous kelp forests off the coast of California, is a good example of macrophytic algae. True macrophytic algae is uncommon in Colorado. However, *Chara* spp., a close relative of macrophytic algae, is commonly found in Colorado ponds and often mistaken for an algae. *Chara*, also known as musk grass due to its characteristic strong musty or garlic odor, feels coarse to the touch because of the mineral deposits that cling to its surface. This gives rise to another common name, stonewort. Since *Chara* is not usually a backyard pond "pest," little more about it will be covered in this article.

Just like so many things beneficial to us, too much algae can be a serious problem.

Even when water is properly circulated, such as with waterfalls or fountains, filamentous algae can be present. Photo: Lou Keenan.

Taste and odor problems in drinking water, and sometimes even fish kills, are associated with excessive "blooms" of planktonic algae—not to mention what they do to the looks of a small backyard pond. Dense growths of filamentous algae seem to strangle aquatic plants and make a mess of rocks, waterfalls and other features of a small pond, ruining their intended uses. Total pond coverage by dense algae growth can restrict sunlight penetration and limit, or actually consume, dissolved oxygen critical to the health of fish, like koi and goldfish.

When algae abundance is out of control and interfering with the intended use of the pond, it is time to fight back. Before you reach for the aquatic herbicide you think is a quick fix, you should first consider the cause of the problem. By using chemical herbicides you may actually be contributing to the recurring algae problem you are trying to control.

Preventative algae management is the best management practice. In order to suppress algae and other undesirable aquatic vegetation growth from getting out of hand, we need to have an understanding of what drives the plants to grow in the first place.

From the moment you fill your pond with water, changes begin to take place. The changes are basically natural but are easily influenced by human inputs. We refer to the changes in the biology and chemistry of a pond as "succession." Some of the changes are rapid, while others are very slow and subtle. The aquatic biota (plant and animal life) in a pond, large or small, is alive and always in motion. A pond is a dynamic system.

The pond's chemistry, plants and macro and micro organisms are directly affected by various depressants or stimuli that wind up in the water. The bigger the pond, the easier it is for the pond to take care of itself. The smaller the pond, the more sensitive it is to these stimulant or depressant factors. Small ponds do not have the natural resources to assimilate excessive inputs, good or bad, fast enough to prevent the consequences that may develop (i.e., algae blooms that result from plant growth stimulating nutrients).

Bioaugmentation is a selective process by which the pond caretaker can give Mother Nature some much needed help in "naturally" suppressing algae and other aquatic vegetation problems, rather than trying to clean out the excessive plant growth after it has gotten out of hand. Keep in mind, excessive algae and macrophytes (submersed aquatic weed plants) are symptoms of the problem, not the core of problem.

You cannot eliminate 100 percent of the algae from your pond. You need to set a goal, or threshold level, of algae and macrophytes that is acceptable to you or your pond situation. Some algae is actually beneficial. Threshold levels can, and do, vary, depending upon the pond caretaker. The challenge is to manage your pond to prevent algae and macrophytes from exceeding your acceptable threshold level.

Many small ponds do not have the benefit of flushing or water exchange. If at all possible, exchange up to half of the water in your pond with fresh water at least twice each year, in spring and fall. It is important that the water in a small pond be circulated by a pumping system, display fountain or any other means for 12 or more hours per day.

"New" laboratory cultures of specific strains of bacteria and enzymes are available for microbial inoculation. The newly discovered benefits of these safe and naturally occurring "bugs" are remarkable. They accelerate the decomposition of organic matter, reducing the rate of sludge build-up. The most important characteristic of these beneficial microorganisms is their ability to consume large amounts of nitrogen and phosphorus in the water, the two most important plant growth nutrients stimulating the algae and macrophytes. The consumption of these nutrients will effectively retard the growth rates of algae by denying them the availability of the critical nutrients required in their life cycles.

Red planktonic algae. Photo: Lou Keenan

Many kinds of aquatic plants are known for their ability to uptake nutrients and pollutants. Adding some of these "filter" plants to your pond will be beneficial. One submerged aquatic plant known for its phenomenal ability to absorb huge quantities of nutrients from the water is coontail (*Ceratophyllum demersum*). A rootless, submerged aquatic plant readily available from local aquarium stores, it is well suited for small pond nutrient extraction. To remove the nutrients from your pond, you must harvest the coontail periodically, leaving some to grow and repeat the process. You'll easily see the enormous advantage of using filter plants rather than aquatic herbicides. Since aquatic plants, including algae, absorb and hold nutrients in their tissue, to kill them with chemicals and allow them to decompose in the pond and release the nutrients back into the water does nothing to correct the cause of the algae problem. Harvesting some of the filter plant material, including filamentous algae growth, removes the nutrients from the water. You can use the harvested aquatic vegetation in your flower beds—it has about the same fertilizer value as a good cow manure.

Grass carp or white amur (*Ctenopharyngodon idella*) are Asian fish belonging to the minnow family. They can grow up to 100 pounds. They are plant feeders—think of them as underwater cows grazing in your pond. However, they have food plant preferences just like real cows, who would rather eat clover than cactus. Grass carp are not good algae biological control agents. However, stocked at the proper density, they are excellent for controlling macrophyte nuisance plants like duckweed (*Lemna* spp.), pondweed (*Potamogeton* spp.), milfoil (*Myriophyllum* spp.), waterweed (*Elodea* spp.) and other common pond weeds. Grass carp don't like water lilies, but they may feed on them if there are no preferred plants available.

Recent developments in the application of ozone enhanced aeration systems are well worth investigating. Ozone is not toxic to fish, plants or the environment when used in pond water systems. The ozone will safely kill many of the unicellular planktonic algae and make the water clearer.

Shading, sunlight and temperature play a critical role in the development of most aquatic organisms. You cannot control the water temperature, but you can, and should, manage the sunlight's penetration into the pond. The energy from the sun drives aquatic plant growth and photosynthesis, just as it does for terrestrial plants. If you have a very well managed pond with crystal clear water, the penetrating sunlight can work against you. By applying very small amounts of a sun shade product, you can disperse the sun's rays and retard the growth rate of some aquatic vegetation, including algae.

Pond caretakers and others interested in pond water and aquatic vegetation management are encouraged to investigate before they invest. The information provided in this article is only introductory. Much more information is available from Denver Botanic Gardens' professional staff and members of various local water garden clubs.

Product Sources:

(The use of trade names does not imply endorsement.)

1. Circulation pumps, display fountains and other mechanical pond equipment.

True Pump, 1429 South Broadway, Denver, CO 80210 (303) 744-3505

2. Beneficial micro-organisms, bacteria/enzyme products.

Enviro-Reps International, 515 Calle San Pablo, Camarillo, CA 93012 (805) 383-4422

3. Filter plants.

Most aquarium stores (may have to be special ordered) or Lilypons Water Gardens, 1-800-999-5459

4. Water purification, ozone systems.

Gas Purification Systems, Inc. 3213 W. Hampden Ave., Englewood, CO 80110 (303) 781-9706

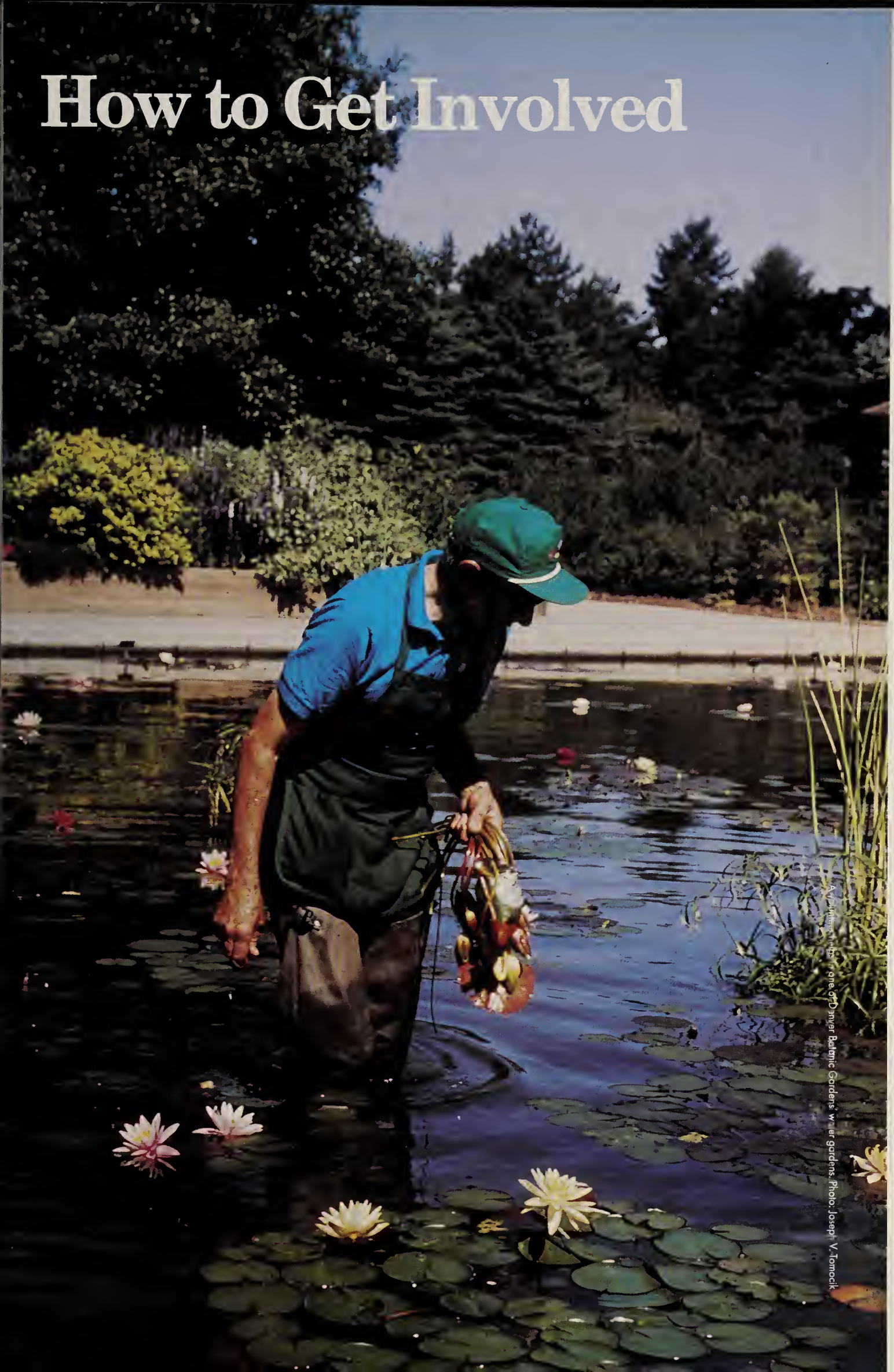
5. Shading products, aquatic plant growth suppression.

Aquashade Inc., 1-800-558-5106

6. Grass carp.

Cline Trout Farms, 5555 Valmont Road, Boulder, CO 80301, (303) 442-2817

How to Get Involved



A volunteer tends one of Denver Botanic Gardens' water gardens. Photo: Joseph V. Tomocik

History of the Colorado Water Garden Society

by John B. Mirgon

A water garden society—in Colorado's Mile High City? A few years back this question was asked by many people around the United States. Before long the society became well-known in the U.S., and other countries around the world noticed Colorado's interest in water gardening. Since the Colorado Water Garden Society's beginning, other water gardening societies have formed, and water gardening has become one of the fastest growing branches of horticulture.

The birth of the Colorado Water Garden Society was initiated by Denver Botanic Gardens' aquatic horticulturist Joseph V. Tomocik. He gave a class on *Nymphaea* (water lilies) on Feb. 13, 1983. He asked anyone interested in forming a water lily society to remain after the class. Ten people remained. Three were willing to accept officer positions for the society's board of trustees: myself, president; Jody Cue, vice president; and Scott Sprague, secretary/treasurer. The seven others who served as supporting members were very helpful later as committee chairpersons and with other activities.

Correspondence soon began with commercial water gardening suppliers to learn about how other plant societies—water gardening societies in particular—were structured. However, when registering with the Royal Horticultural Society in England, the board was informed that there were no other water gardening societies. It is very possible that Colorado's water garden society was the first in the world. To the board this meant one thing—they were on their own.

During the next few weeks meetings were held to write—and rewrite—the society's constitution and to put together committees and assign chairpersons. It was decided to name the society the "Colorado Water Garden Society" rather than the "Denver Water Lily Society," which might have restricted the membership. By April 2, 1983 the constitution was written to satisfaction, and on April 24, the first Colorado Water Garden Society general meeting was held in Denver Botanic Gardens' administrative building, the Botanic Gardens House. From this meeting the society has grown to what it is today. On April 2, 1997 the society entered its 14th year.

On May 11 and 12, 1984 the Colorado Water Garden Society (CWGS) made its first appearance at Denver Botanic Gardens' Plant and Book Sale. Each year since the society has handled the aquatic and bog plant section of the sale. A day for garden and pool tours of the CWGS members also was started in 1984. A barbecue or picnic now ends the day of this annual event.

In June, 1985 the CWGS held its own first plant sale. Since the Gardens' May sale was too early to sell tropical *Nymphaea,* the focus of the June event was the auction of these tropical water lilies. Of course, hardy *Nymphaea* and other aquatics also were sold. This sale, too, has become a yearly event for the CWGS. Also in 1985, CWGS members were first present at garden centers for weekend seminars and events to answer questions and inform people about water gardening. Members still participate in these weekend events, helping meet one of the CWGS objectives—to stimulate the study and culture of aquatic plants.

In 1986 the CWGS was invited to exhibit at the Colorado Garden and Home Show in the Horticultural Hall. This was the society's first showing before the public. Because of its affiliation

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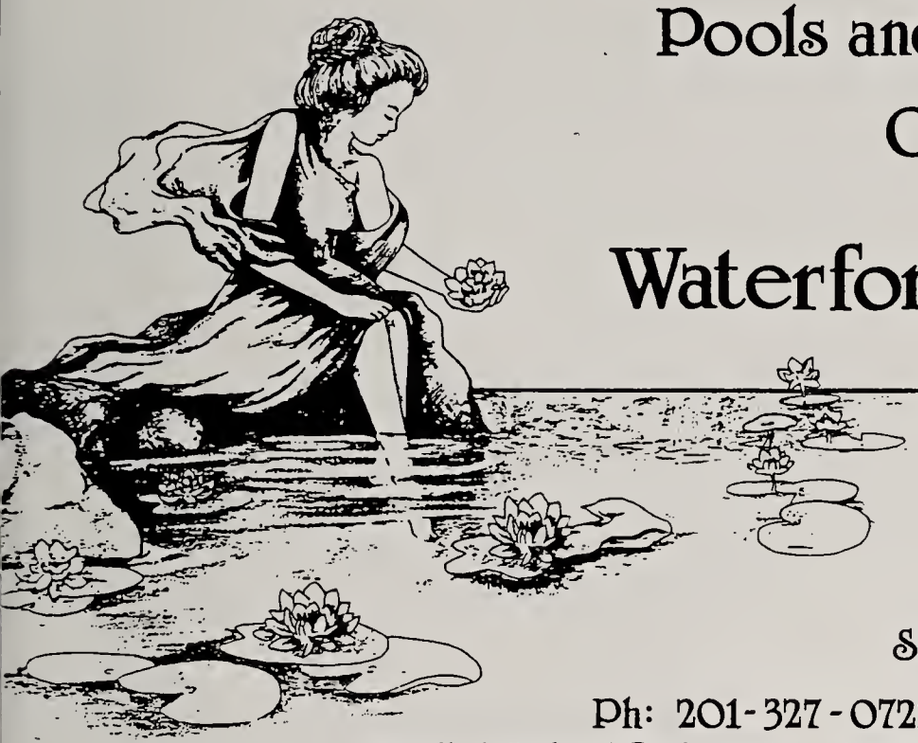

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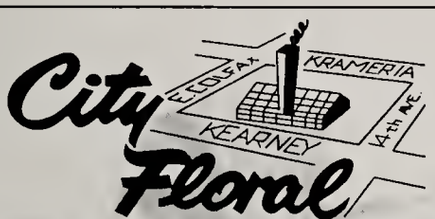

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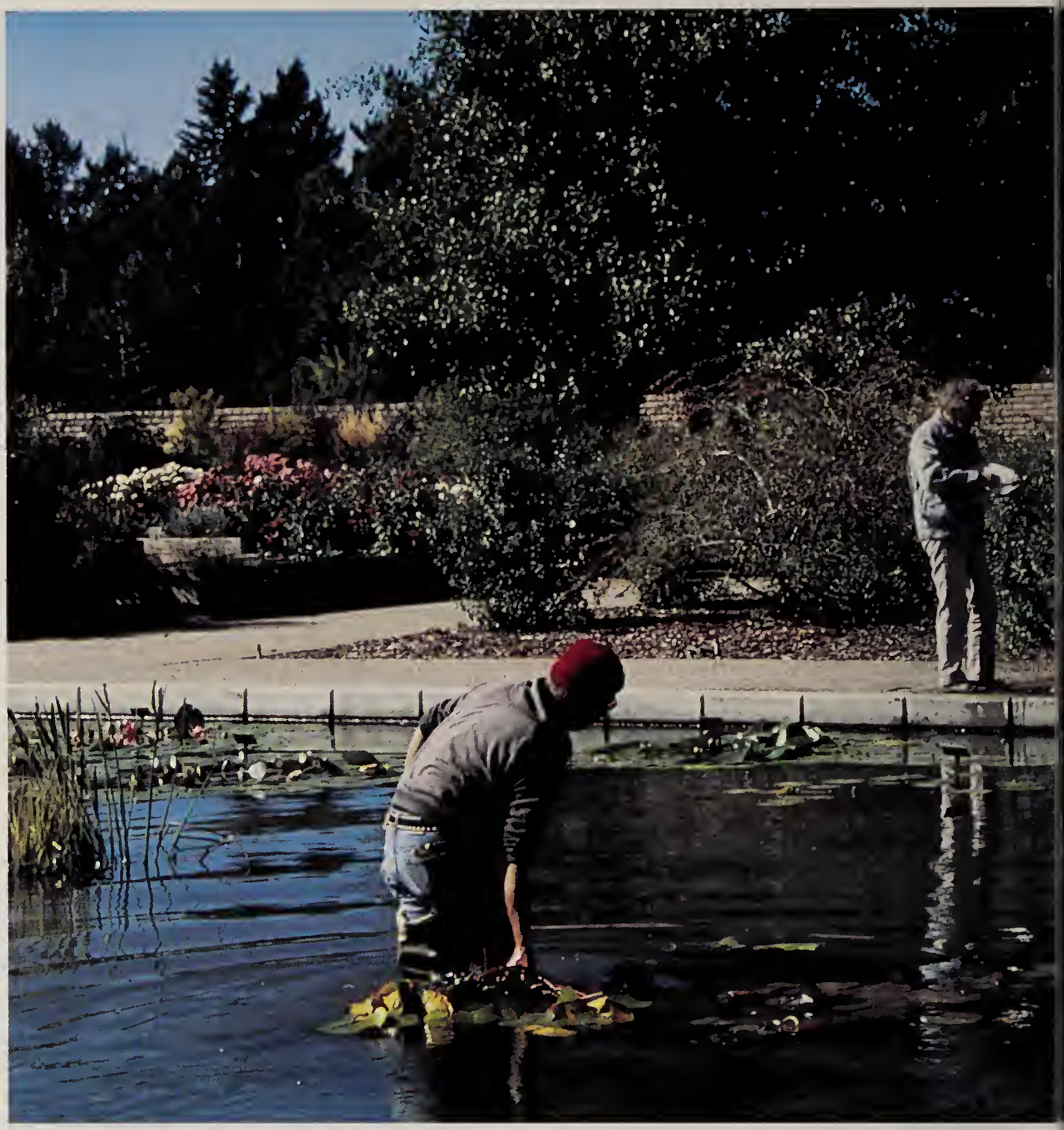


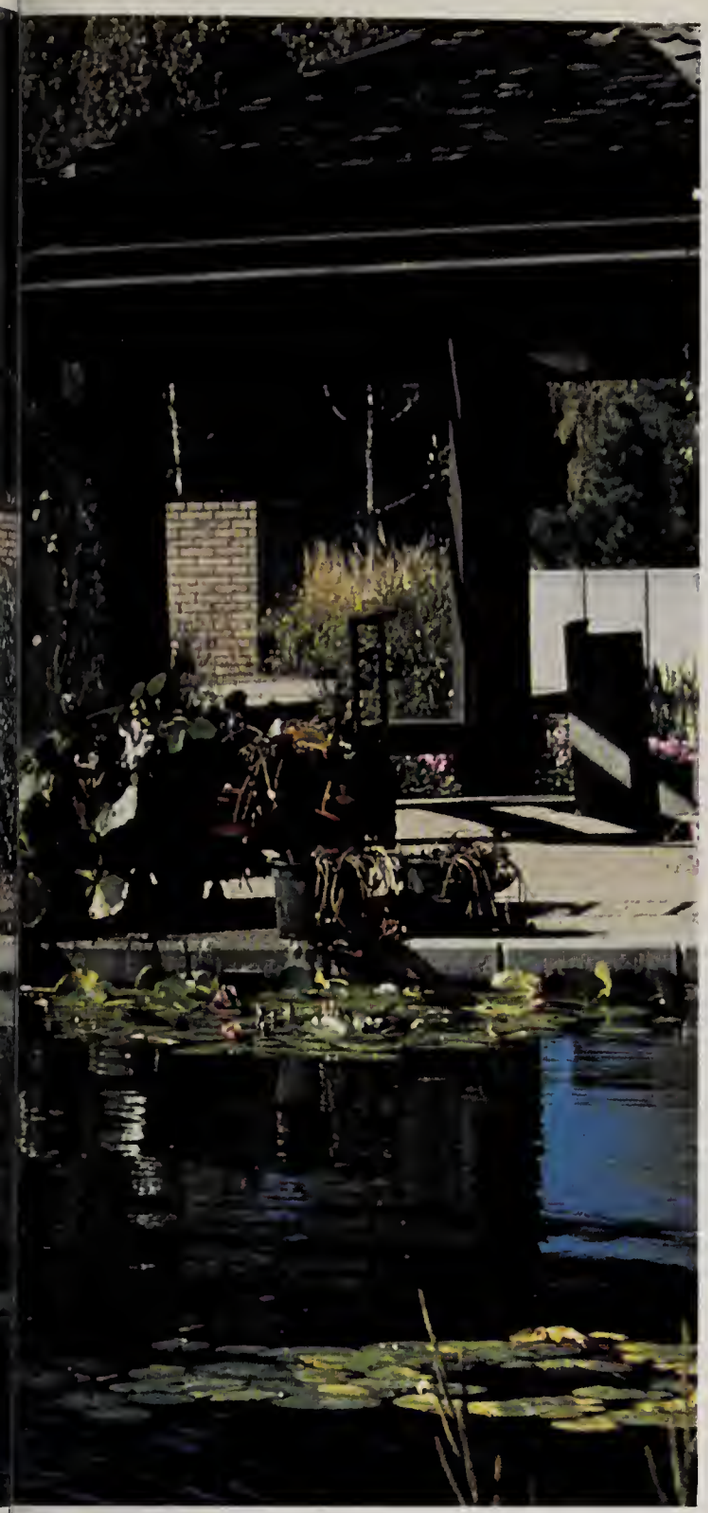
Colorado Water Garden Society members regularly volunteer at Denver Botanic Gardens. Photo: John Mirgon.

with the Colorado Federation of Garden Clubs, the society has been present each year since. Also in 1986, CWGS members joined with speakers from Lilypons Water Gardens and a speaker from England and held a mini symposium.

In 1987 the CWGS started an endowment fund at Denver Botanic Gardens. The funds are used for the Gardens' aquatic plant collection and other related water gardening expenses. Contributions have continued most years since. The same year, the CWGS and the International Water Lily Society held the International Water Lily Society Symposium at Denver Botanic Gardens.

In the May, 1990 issue of *Horticulture* magazine, associate editor Teri Dunn wrote an article "The Colorado Water Garden Society." The article told about the CWGS and water gardening in the Rocky Mountain region. It also told about Denver Botanic Gardens' aquatics and Tomocik's work with *Nymphaea*. Thanks, in part, to the interest generated by this issue, the CWGS membership rose to more than 300 people.

In August, 1994 at Sparsholt College in Winchester, Hampshire, United Kingdom, the International Water Lily Society presented an Award of Appreciation to the Colorado Water

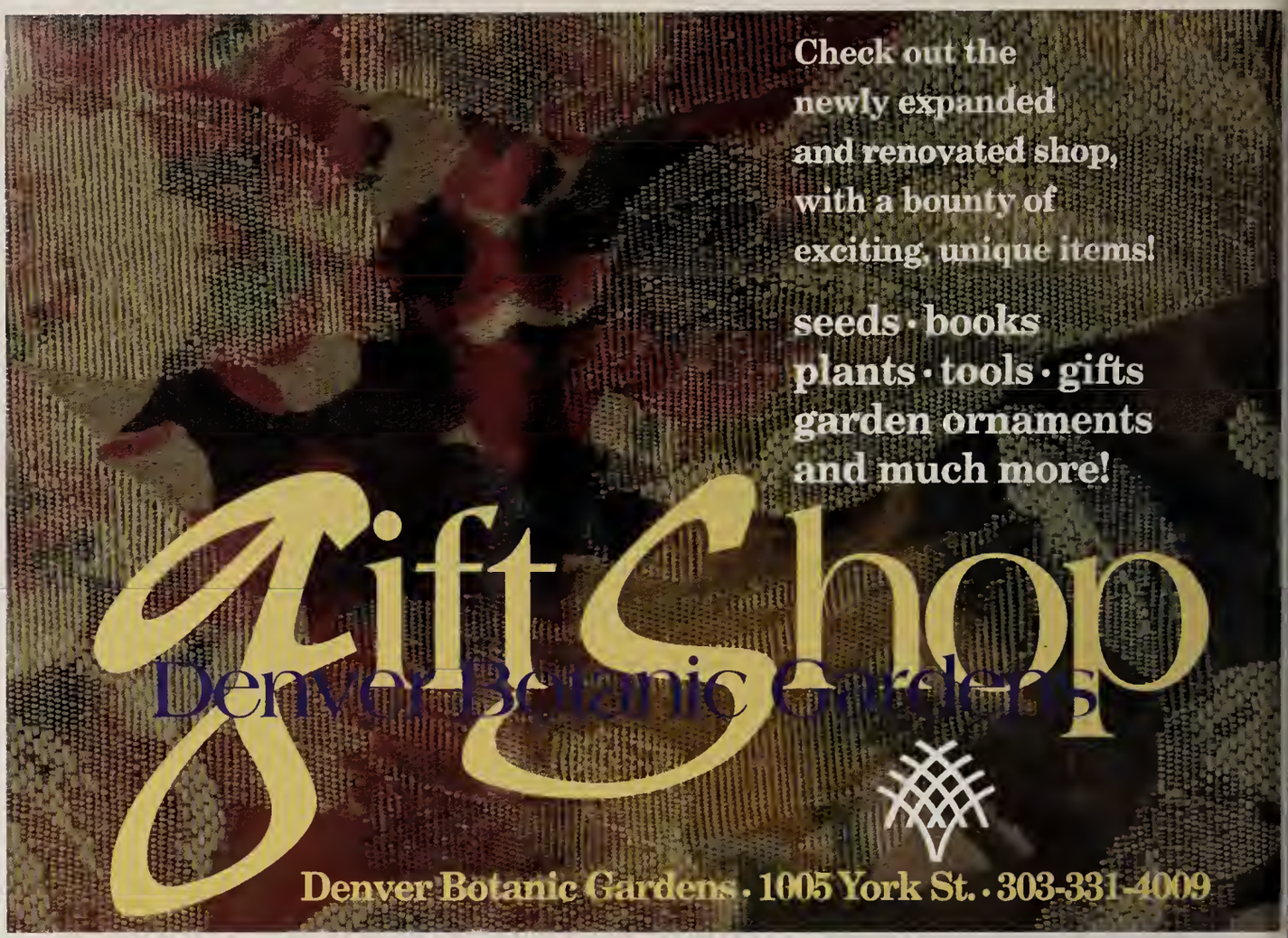


CWGS meetings are held the second Sunday of April, June, July, August and September at 2 p.m. at Denver Botanic Gardens. Seven newsletters per year are sent out to CWGS members. Annual dues are $10 for individuals, $15 for families or couples. For more information on the Colorado Water Garden Society, call 303-331-4000.

Garden Society. The award recognized CWGS's contributions to the International Water Lily Society's purpose of promoting the appreciation and enjoyment of water gardening.

Currently, many CWGS members volunteer at Denver Botanic Gardens throughout the year. Each fall members help put away the aquatics for the winter. In spring they help repot the aquatics and place them back into the pools for the summer display. The society also participates in community projects, such as the one at the PorterCare Hospital, where *Nymphaea* have been placed in a pool for the enjoyment of the patients and visitors. Also, work has begun in cooperation with the Denver Parks and Recreation Department in restoring an old water lily pool in City Park.

Going into its 14th year, the CWGS average membership is 200. The Colorado Water Garden Society has inspired other water gardening societies around the country and in England. This August the International Water Lily Society Symposium again will be held in Denver—10 years after it first was held here. The Colorado Water Garden Society has come a long way since that February afternoon 14 years ago.



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"Planting Waterlilies" by Kim Mackey.

The Outdoor Gardens of Denver Botanic Gardens

Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens • Volume 54 No.2 • Fall 1997

The Outdoor Gardens of Denver Botanic Gardens

What does Rocky Mountain horticulture mean to you? The phrase is part of Denver Botanic Gardens' mission statement and is one that our staff and board of trustees periodically struggle to define. For us it seems a critical concept to elucidate so that we might distinguish our work from that of other botanic gardens in this country, if not the world.

Yet, how does one compare the virtues of a fine rock alpine garden against an exemplary regional rose garden, herb garden or perennial border? Is a water-smart garden more "Rocky Mountain" than a world-class aquatic plant display that just happens to be in this locality?

Such moot questions sometimes lead us to turn and broaden the phrase into the more inclusive concept of horticulture in the Rocky Mountain region. It would seem that the uniqueness of our high altitude climate, topography and soils cannot be separated from any type of horticultural pursuit here, so that each well-executed variation of regional gardening has the potential to become a benchmark of its type. The key is to understand and take advantage of our regional uniqueness rather than struggle against it.

The original Denver Botanic Gardens master plan was created by the preeminent American landscape architect Garrett Eckbo and laid the groundwork for nearly four decades of development at the York Street site as ideas for gardens were envisioned, funded and installed. Construction of new gardens and refinement of existing displays continues today as our regional horticultural style evolves and matures, an exciting and dynamic process.

The attributes of design, construction, plant diversity and maintenance practices that reflect our region's character are the basis for this issue of *Mountain, Plain and Garden*. We've chosen just over a score of our numerous outdoor gardens at the York Street site and Chatfield Arboretum as examples, comprising the first chapter. Introductory information about eac garden includes information on its age, histor and designer. Plant lists emphasizing a variety c themes accompany the text about each display.

The second section has "behind the scenes information on the horticulture department. short third section that we call "vital statistics will give you an idea of what DBG is today. A the end of the publication, you'll find som exciting insights into our plans for garden devel opment in the near future.

Sincere thanks go to Ken Slump, who crafte this issue. I also want to acknowledge the fol lowing DBG horticultural volunteers and pre sent as well as former DBG horticultural staf who contributed information for this publica tion: Ann Berthe, Rich Bishop, Suzie Brown Beverly Capron, Anna Condit, Gary Davis Loddie Dolinski, Chris Hartung, Laini Jackson, Dan Johnson, Panayoti Kelaidis, Kath Kircher, Julie Loquidis, Joann Narverud, Ber Rhodes, Nick Snakenberg, Vanessa Tatsch, Jo Tomocik and Amy Yarger.

Our goals are that you not only learn mor about the many gardens that comprise Denve Botanic Gardens, but also gain insight into som of the unique attributes and horticultura approaches that are the fabric of our displays s that you might find new ways of approachin and improving your own version of Rock Mountain horticulture.

James E. Henric
Director of Horticultu

Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens
Volume 54, Number 2 • Fall 1997

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Front cover photo: Daylily garden. Photo: Richard H. Daley.

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Produced by the Marketing and Special Events Department of Denver Botanic Gardens.

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Chapter 1

THE GARDENS

Annual Display Gardens

From the late 1950s through the 1960s annual trials were the major summer display at Denver Botanic Gardens consisting of bed after bed and row after row of vividly colored plants. As permanent garden development at the Gardens progressed, the area devoted to annual trials was reduced and eventually eliminated. Annuals still are an important aspect of our summer gardening program, but we no longer feature annual trial areas. The designs for our annual beds are created by DBG staff member Joann Narverud.

One of the most remarkable and gratifying differences of gardening in the Rocky Mountain region is the wonderful way annuals grow and flourish during our summers. Whether this is a result of the high altitude sunlight, low humidity, cool nights, mineral-rich soils, or a fortunate combination, many varieties of annuals explode with color in Colorado as well or better than anywhere else on the continent.

The long colorful season of floral display that annuals provide has always been an important component of summer horticultural displays at Denver Botanic Gardens. In the early years we grew many cultivars in trial plots that were our summer mainstay. Those displays offered local gardeners and garden center professionals an opportunity to compare varieties, thus choosing the best ones to grow in our region.

Annuals still play an important role in our summer gardens. We have a number of beds devoted exclusively to annuals. Rather than planting them in rows, as with a typical trial garden, we paint the summer landscape with them. Planting style varies among the beds from those with formal geometric designs, to imitations of perennial garden style, to representations of wildflower meadows.

In addition, we add them to the plantings of our permanent gardens for seasonal color. They are incorporated into plant displays of primarily perennial herbaceous plants, such as the daylily and iris gardens, water-smart garden, perennial border, herb garden, cutting garden and the public gardens outside the fence along York Street.

Among horticulturists there is a resurgence of interest in annuals. Intriguing new species are being introduced with unusual growth habits and flower forms. Some provide textural elements difficult to obtain with hardy plants in this region. Annuals are grown for their foliar effects, too. Types with variegated and colored leaves can be particularly effective when combined with other plants. It is instructive to note that some species we grow here as annuals actually are perennial plants from warmer climates that will not survive our winters.

Annual display bed. Photo: Ken Slump.

Accent annuals with purple or reddish foliage

Amaranthus cruentus	purple amaranth
Brassica oleracea 'Peacock Red'	Peacock Red flowering kale
Celosia 'Amazon'	Amazon celosia
Celosia 'New Look'	New Look celosia
Dahlia x 'Redskin'	Redskin dahlia
Datura innoxia 'Purple Pirouette'	Purple Pirouette thorn apple
Lablab purpureus 'Ruby Moon'	Ruby Moon hyacinth bean
Ocimum basilicum 'Purple Ruffles'	Purple Ruffles basil
Pennisetum setaceum 'Rubrum'	purple fountain grass
Perilla frutescens 'Atropurpurea'	shiso
Ricinus communis 'Carmencita'	Carmencita castor bean
Tropaeolum majus 'Empress of India'	Empress of India nasturtium

Chatfield Arboretum Dryland Perennial Gardens

The designs for the plantings around the administration building and nature center were create by Boulder author and landscape architect Jim Knopf as a water-wise wildlife garden; plantin was begun in 1991. Local author and horticulturist Marcia Tatroe designed the Western dryland plantings around the visitor center, which were started in 1992.

As the landscaping at Chatfield Arboretum evolved, it was decided that the plantings around the visitor center, nature center and the administration buildings would be appropriate sites to develop gardens requiring a minimum of irrigation. Now that five or six years have passed, the gardens are beginning to assume a mature appearance. Dryland perennials and adapted shrubs comprise the plantings, which change seasonally but always display a decidedly Western style.

These dryland perennial plantings send a strong message that gardens do not have to sacrifice color, lushness and botanical interest in order to conserve water. Many, although not all, of the species in these gardens are native.

The diversity of texture and form in this plant palette is striking. There is a broad range of alternatives and/or additions to cactus and yucca. Due to most visitors' unfamiliarity with these plants, plant labeling is especially important, and Chatfield Arboretum horticulturist frequently are asked to identify interesting species.

The result of mixing shrubs, small trees and native grasses with perennials often can appear artificial or forced when using "traditional" landscape plants. Perhaps because they have evolved to thrive under similar conditions, the plants combined in these gardens blend in a soothing, natural way.

Most admirers of these plantings would be surprised at the minimal maintenance required. Spring clean-up consists of cutting back all the dead stems and flowers from the previous season. The beds are weeded once or twice in early summer, and the rest is left to Mother Nature.

Chatfield Arboretum dryland perennial garden. Phata: Chatfield Arboretum.

The gardens are watered about eight times per season (about every three weeks). About a half-inch of water is applied. Many of the plants do not require irrigation, but generally they are fuller and bloom longer with additional moisture. Plant pests and diseases are seldom problems, and fertilizers are not regularly applied.

A number of the species employed in these designs are increasingly available at regional nurseries and garden centers, but many still are elusive. Hopefully, as our regional gardening style evolves, demand for such plants will increase, and they will become inexpensive and easy to locate.

Colorful dryland plants at various times of the growing season

Agastache cana	mosquito plant (late summer, fall)
Asclepias tuberosa	butterfly weed (summer)
Berlandiera lyrata	green-eyes (summer, fall)
Eriogonum corymbosum	wild buckwheat (summer, fall)
Eriogonum niveum	wild buckwheat (summer)
Penstemon richardsonii	Richardson penstemon (fall)
Pulsatilla patens	eastern pasque flower (early spring)
Thelesperma filifolium	greenthread (summer, fall)
Thermopsis rhombifolia	golden banner (early spring)
Townsendia exscapa	Easter daisy (early spring)
Zauschneria californica	California fuchsia (summer, fall)

Alternatives to water-guzzling trees and shrubs

Amorpha nana	dwarf lead plant
Caryopteris x *clandonensis*	bluebeard
Crataegus phaenopyrum	Washington hawthorn
Fendlera rupicola	cliff fendlerbush
Forestiera neomexicana	New Mexican forestiera
Hippophae rhamnoides	sea buckthorn
Holodiscus dumosus	rock spirea
Prunus tomentosa	Nanking cherry
Ptelea trifoliata	hop tree
Quercus macrocarpa	bur oak

Chatfield Arboretum Windbreaks

The first windbreak plantings at Chatfield Arboretum were started in 1983. Planting of the 1 windbreaks continued for about a decade.

Windbreaks were one of the first plantings made by settlers of the American West as they estab lished their prairie homesteads because they protected homes and croplands from wind erosion Likewise, they also were among the initial plantings made by Denver Botanic Gardens soon after th Chatfield Arboretum acreage was leased from the U.S. Army Corps of Engineers. Although initiall some irrigation was needed to aid in the plants' establishment, the conifers, trees and shrubs tha comprise the windbreaks now survive primarily on natural rainfall. They provide habitat for a myria of wildlife and demonstrate useful lessons on woody plants suited to Front Range environments.

In 1992 Chatfield Arboretum received the Jefferson County Soil Conservation Award for cultivating 80 species of drought-resistant trees and shrubs as windbreaks. In actuality, more than 90 different kinds of deciduous and coniferous trees and shrubs are incorporated in Chatfield Arboretum's 10 windbreaks, and each windbreak is unique in the blend of species that grows in it. These trees not only provide a demonstration of how such plantings can modify a site's microclimate, but also comprise a tried-and-true list of some of the toughest landscape plants for the region. These plantings endure skimpy rainfall, severe winds and harsh fluctuations in daily and seasonal temperature.

Windbreaks serve a variety of practical functions in climate modification. In addition to the obvious purpose of wind reduction, they also harvest and distribute snow and reduce noise. For all this benefit, visitors would be surprised at how little care the windbreak plants receive.

As a bonus, a huge variety of wildlife has made its home in and around these plantings. Numerous species of birds, rodents and snakes live in the shelterbelts. Deer, elk, coyote, porcupine and rabbit also live throughout the groves. As development occurs in the surrounding area, these plantings provide precious oases in the face of shrinking wildlife habitats.

The lack of horticultural heroics in the establishment and maintenance of the windbreaks is testament that landscapes can exist here with a minimum of pampering.

Chatfield Arboretum windbreaks. Photo: Chatfield Arboretum.

Toughest trees and shrubs in the Chatfield Arboretum windbreaks

Acer grandidentatum	bigtooth maple
Chrysothamnus nauseosus ssp. *hololeucus*	tall blue rabbitbrush
Crataegus ambigua	Russian hawthorn
Juglans nigra	black walnut
Juniperus monosperma	one-seed juniper
Juniperus scopulorum	Rocky Mountain juniper
Pinus cembra	Swiss stone pine
Pinus ponderosa	ponderosa pine
Prunus americana	wild plum
Prunus mexicana	big-tree plum
Prunus virginiana	chokecherry
Ptelea trifoliata	hop tree
Rhamnus smithii	Smith buckthorn
Rhus trilobata	skunkbush sumac

Cutting Garden

Work began on the cutting garden at Denver Botanic Gardens in 1981 and provided a long awaited space to grow flowers and plant material to harvest for use at the Gardens. Longtime DBG volunteer Lainie Jackson has honed the cutting garden collection into a blend of the best of the old and most exciting of the new in cut flower varieties. The layout of the raised beds was designed by former DBG staff member Gayle Weinstein.

One of gardening's biggest pleasures is producing fresh flowers to enjoy in the home and to share with friends. A savvy horticulturist may also grow blossoms suitable for use in dried arrangements or craft projects—useful and appreciated during the "idle" months of a gardener's winter.

The purpose of the cutting garden is to grow and demonstrate the cultivation of some of the best annuals, perennials, grasses and shrubs for cutting and/or preservation. The garden's raised bed design is attractive and eases maintenance.

Long stems and good lasting qualities are definite plusses for cut flowers, and species vary considerably. Even within a species, some varieties are better suited for cutting than others.

Most of the flowers grown in the cutting garden are perennials; about 25 percent are annuals. Visitors enjoy finding their old favorites growing here, but new varieties are tested each year, too. The display must last all season. To accomplish this, species are carefully chosen and plants are groomed for maximum display longevity.

The plant material produced in the cutting garden is used in floral arrangements at DBG throughout the year. Volunteers also harvest and preserve items that are sold at DBG's popular holiday sale each November. Plant material from this garden is preserved by air drying.

Cutting gorden. Photo: Denver Batanic Gordens.

Lainie Jackson's favorite cutting garden perennials

Achillea 'Moonshine'	Moonshine yarrow
Allium christophii	star of Persia
Buphthalmum salicifolium 'Sunwheels'	Sunwheels ox eye
Dendranthemum x *grandiflorum* 'Snowball'	Snowball chrysanthemum
Gypsophila paniculata 'Pink Star'	Pink Star baby's breath
Hylotelephium spectabile (syn. *Sedum spectabile*) 'Indian Chief'	Indian Chief sedum
Iris 'Victoria Falls'	Victoria Falls iris
Monarda didyma 'Marshall's Delight'	Marshall's Delight bee balm
Phlomis russelliana	phlomis
Vernonia missurica	ironweed

Cutting garden plants that you won't find at the florist

Avena sativa	French black oats
Carlina acanthifolia	acanthus-leaved thistle
Corylus avellana 'Contorta'	Harry Lauder's walking stick
Echinops exaltatus	globe thistle
Eriogonum umbellatum	sulphur flower
Eryngium amethystinum	amethyst eryngo
Eucalyptus 'Silver Plate'	Silver Plate eucalyptus
Lagurus ovatus	hare's tail
Leonurus sibiricus	leonurus

Daylily and Iris Gardens

For decades, the local daylily (*Hemerocallis*) and iris societies have been associated with Denve Botanic Gardens and have been instrumental in building and maintaining gardens of the high est quality for each of these popular genera. Over the years, DBG has been involved in hostin national meetings for both societies.

The garden designs for both collections have been reconfigured in recent years. Local landscap designer Diane Byers created the plan for the daylily garden, with Mile High Daylily Society mem bers Anna Condit and David Freeman selecting the large diversity of species and cultivar daylilies tha are displayed in the collection. DBG staff member Joann Narverud designed the new iris beds.

Daylilies and iris are two popular garden plants that do particularly well in Colorado because of our winter conditions. Soils are not soggy in the cold months, and the bright winter sun promotes continued growth.

During the past several years, the gardens for both the daylily and iris collections have been transformed. Until quite recently, the displays consisted of row after row of cultivars representing both genera. They were the highlights of the outdoor collections when at their floral peaks, but of little interest during the year's other 10 or 11 months.

With careful planning and selection of appropriate species and cultivars, the season of iris bloom can stretch to 10 or 12 weeks and more. The public is most familiar with the hybrids properly known as tall bearded iris, whose peak season is mid to late spring. Their smaller cousins, called dwarf bearded iris, typically flower earlier. Both are rhizomatous iris, but bulb-producing species exist as well. Another species, spuria iris, also produces a rhizome and tends to bloom later than the bearded irises.

Some of the bulb producing species are among the earliest spring flowers to bloom. Siberian iris are yet another rhizomatous type that grow well in this area. Their flowering season is typically late spring to early summer.

The daylily is one of the most frequently hybridized garden plants, with hundreds of new varieties registered annually. The plant may be grown across most of this continent, but all varieties do not perform equally well in every region. Although the primary daylily flowerin season occurs in the middle of the summe there are early, mid and late season varieties With careful selection, gardeners can hav daylilies in flower from late May until fros Hybrids with the capacity for repeat flowerin have emerged, and more are being developed.

Daylilies are particularly suitable companio plants to many spring flowering bulbs. Th daylily foliage emerges just in time to mask th

Daylily garden. Phata: Wendy Tucciarone.

yellowing leaves of tulips and daffodils. Other plants particularly complementary to daylilies are those with fine textures, such as yarrow and fountain grass. Plants with red and purple hues in their flowers and foliage also enhance subtle foliage tones in a number of daylily hybrids. Plants with glaucous or silvery leaves can provide yet another attractive contrast.

In their renaissance, the beds in both the iris and daylily collections have been redesigned into informal displays that incorporate shrubs, bulbs, annuals and other perennials. This scheme has increased the collections' beauty through three and even four seasons of interest.

Anna Condit's favorite daylilies for a long season of bloom

Hemerocallis 'Autumn Minaret'	yellow, late season
Hemerocallis 'Chicago Ruby'	deep red, mid season
Hemerocallis 'Chorus Line'	rose pink, early season
Hemerocallis 'Hudson Valley'	light yellow, mid season
Hemerocallis 'Janice Brown'	pink with red eye, mid season
Hemerocallis 'Olive Bailey Langdon'	purple, early season
Hemerocallis 'Open Hearth'	red/copper bi-tone, reblooming
Hemerocallis 'Paper Butterfly'	lavender and peach, early season
Hemerocallis 'Parade of Peacocks'	rose peach, mid season
Hemerocallis 'Pardon Me'	red, mid season and reblooming
Hemerocallis 'Red Volunteer'	deep red, mid season
Hemerocallis 'Stella de Oro'	golden yellow, reblooming
Hemerocallis 'Strutter's Ball'	purple and black, mid season
Hemerocallis 'Suzie Wong'	light yellow, early season
Hemerocallis 'Three Seasons'	lemon yellow, reblooming
Hemerocallis 'White Temptation'	near white, mid to late season

An array of iris for Colorado gardens

Iris 'Batik'	violet, random light patterning, mid season
Iris 'Beverly Sills'	coral pink, ruffled, mid season
Iris 'Cherry Tart'	warm grey and burgundy, mid season
Iris 'Immortality'	yellow and cream, mid to late season
Iris 'Laced Cotton'	white, ruffled, mid to late season
Iris pallida var. *variegata*	lilac blue flower, variegated foliage, late season
Iris reticulata	violet to blue, early season
Iris sibirica 'Orville Fay'	medium blue, mid to late season
Iris sibirica 'Marantha'	royal purple, mid to late season
Iris spuria 'Dawn Candle'	white and creamy yellow, late season
Iris spuria 'Highline Bluebird'	violet, late season
Iris 'Superstition'	ebony, mid season

Environmental Gardens

The xeriscape demonstration garden, Gates Montane Garden and Laura Smith Porter Plains Garden make up the "environmental gardens," a recent and appropriate term Denver Botanic Gardens has applied to these three collections that not only share proximity to one another, but also have a common element in their genesis—to display plants representing a specific plant environment. Creating a naturalistic garden is much more challenging than it may appear; shovels and hoes often produce controlled results.

Xeriscape Demonstration Garden

The xeriscape demonstration garden was one of the first of its type in the region, displaying native and adapted plants suitable for area landscapes that require little or no irrigation. The garden was constructed in cooperation with Denver Water (then known as the Denver Water Board) and was dedicated in September 1987. It was designed by former Denver Botanic Gardens staff member Gayle Weinstein.

The natural habitat around Denver is a mostly treeless high plains grassland. The soils in the vicinity are quite variable. Denver's climate is characterized by bright sunlight, low humidity, large temperature variations daily and seasonally, and periodically strong winds. Typically, the area receives about 15 inches of precipitation each year.

This does not sound like a description of the verdant oasis that irrigation has provided the greater Denver metropolitan area. As with most limited resources in areas of booming population, concern for excessive water use for landscape purposes has mounted regionally in recent years.

The xeriscape demonstration garden was created to provide opportunities to grow and display a variety of plant species for landscapes designed with water conservation in mind. The plants were purposefully organized and displayed in naturalistic plantings representing the xeric environments from which they came.

The communities represented include arid plains, desert, open woodland, parkland and chaparral. The garden's eastern section is designed to illustrate how blue grama turf combined with various woody plants can be adapted for use in a residential setting.

The native and introduced plants in this garden survive for the most part on natural rainfall. The collection includes some superb examples of unusual trees and shrubs as well as many fine succulents. In the 10 years since the garden's dedication, some plants have aggressively competed and overgrown others. In the future, we are planning to restore the original balance of species in the garden and hope to incorporate more plants with seasonal color.

Easy-care landscape plants from the xeriscape demonstration garden

Ceanothus fendleri	Fendler ceanothus
Chamaebatiaria millefolium	fernbush
Cowania mexicana	cliffrose
Cupressus arizonica	Arizona cypress
Fallugia paradoxa	Apache plume
Geum triflorum	prairie smoke
Hesperaloe parviflora	red flowered yucca
Juniperus deppeana	alligator juniper
Mahonia fremontii	Fremont mahonia
Opuntia imbricata	cholla
Penstemon pinifolius	pineleaf penstemon
Peraphyllum ramosissimum	squaw apple
Prunus andersonii	desert peach
Quercus turbinella	shrub liveoak

Gates Montane Garden

The Gates Montane Garden was given to Denver Botanic Gardens as a memorial to Charles C. Gates by his family and friends. The garden was meant to recreate the atmosphere around the family home in Bear Creek Canyon west of Denver. This project, DBG's oldest outdoor display, was begun in 1961. The garden is one of the last designs by one of Denver's most important landscape architects of the 20th century, S. R. DeBoer (1883-1974). In addition to numerous private commissions, DeBoer played a pivotal role in the planning and creation of most of the park and parkway systems in Denver's older neighborhoods.

He was an advocate for the municipal landscape and championed the establishment of a botanic garden in Denver. He wrote, "No large city should be without a botanical garden. It becomes the experimental station for trees, flowering plants, and everything that grows in the region." We are fortunate to have this small part of his legacy.

A stroll through the montane garden is a brief escape that transports visitors from the hectic pace of the city. Its walkway's shady canopy is particularly comfortable on hot summer days. The secluded walk is sheltered by a small forest comprised of many native tree species. Bristlecone, limber, piñon and ponderosa pine all grow in this garden. Aspen and Colorado spruce are found here, too. The ease with which these species thrive validates the worth of choosing native trees and shrubs for the landscape.

Toward the north end of the garden are some of the tallest Gambel oaks likely to be encountered in this region; their vigor, no doubt, is due to the waterway stream that passes nearby. Near the center of the walk, on the east side, is a mature weeping form of Rocky Mountain juniper. The tree is believed to be the clonal parent of all weeping junipers sold under the cultivar name 'Toleson's Weeping'.

One of the best lessons illustrated in this garden is the layering of plants that occurs in a forest. Tall trees capture most of the sunlight and form the top layer. Shade-tolerant shrubs and smaller trees make up the intermediate zone, and shade-loving annuals, perennials, subshrubs and even mushrooms grow at ground level.

In the near future DBG is planning to enhance the garden, particularly toward the pond side, with an array of native wildflowers that can be found in and near Colorado mountain woodland environments.

View across the west pond toward the Gates Montane Garden. Photo: Havey Productions.

Gates Montane Garden species too infrequently seen in regional landscapes

Acer glabrum	Rocky Mountain maple
Aquilegia chrysantha	golden columbine
Betula fontinalis	water birch
Cercocarpus montanus	true mountain mahogany
Paxistima myrsinites	Oregon boxwood
Philadelphus microphyllus	littleleaf mock orange
Pinus aristata	bristlecone pine
Ribes odoratum	clove currant
Shepherdia canadensis	buffaloberry
Symphoricarpos albus	snowberry

Laura Smith Porter Plains Garden

The Laura Smith Porter Plains Garden was named in honor of the mother of one of DBG's founders, Ruth Porter Waring. The garden was completed in 1987 and represents several different grass communities originally found on the Great Plains. Nearly all the species in this garden are native to Colorado.

Inset into the west side of the adobe-style wall is the "Covered Wagon Frieze" created by sculptor Robert Garrison in 1926. These droll depictions of the westward trek by the pioneers served as architectural decoration on the Romanesque-style Midland Savings Building at Seventeenth Street and Glenarm Place in downtown Denver until its exterior was updated in 1964.

After the hailstorm of Aug. 11, 1997, much of the grounds at Denver Botanic Gardens resembled a battle zone. The plains garden, however, was virtually unfazed—certainly a testament that our native plants have evolved to cope with the vagaries of regional weather.

This garden is actually a composite of representations of several different types of grass communities that were found across the Great Plains, including tallgrass, midgrass and shortgrass prairies. Planted in these grass communities are the woody shrubs and forbs that are associated with each.

Visitors often ask if this area is supposed to look as it does, or when DBG is going to develop it. The plains garden is not designed to represent a landscape style that DBG is trying to promote for home gardens, but rather is an attempt to illustrate a vanishing type of plant environment—the one that existed here prior to settlement by the pioneers.

Every two or three years, sections of the garden are burned to replicate the wildfires that lightning periodically starts on the grasslands. These fires are a natural part of the plains ecology and help balance the diversity of species. Some plants' seeds actually germinate better following such fires. Permits are required from the local fire department and the Environmental Protection Agency; the controlled burn must be done on a low-pollution day.

Although the area may look like a weed patch to some, there are a number of species included in the scheme that are popular garden plants, either as species or hybrids thereof. Most visitors would be surprised at the considerable amount of time it takes to keep this garden weeded and maintain representatives of each section's numerous species, many of which were obtained as seed from a few remnants of Colorado prairie.

As a botanic demonstration, the garden is instructive, and in its naturalness, many visitors find subtle beauty. The garden is particularly attractive as autumn arrives and the rustling grasses assume tawny hues.

Durable, decorative grasses from the plains garden

Andropogon gerardii	big bluestem
Andropogon hallii	sand bluestem
Bouteloua curtipendula	side oats grama
Bouteloua gracilis	blue grama
Schizachyrium scoparium	little bluestem
Sorghastrum nutans	Indian grass
Stipa comata	needle and thread

Prairie flowers from the plains garden

Castilleja integra	Indian paintbrush
Gaillardia aristata	blanket flower
Gaura coccinea	scarlet gaura
Helianthus maximiliani	Maximilian sunflower
Ipomoea leptophylla	bush morning glory
Liatris punctata	blazing star
Oenothera canescens	spotted evening primrose
Penstemon angustifolius	narrow beardtongue

Louro Smith Porter Plains Gorden. Photo: Kathy Kircher.

Plains gorden burn. Photo: Jomes E. Henrich.

Herb Garden

The herb garden represents one of Denver Botanic Gardens' oldest outdoor displays as well as nearly 35 years of support from DBG's Herb Guild, a dedicated group of volunteers. The older section, on the west side, consists of five brick paths forming interlocking circles in a traditional bow-knot design. The garden plan was created by Mrs. Persis McMurtrie Owen, a local landscape designer, and was finished in 1965.

The focal point of the original garden is the 1898 statue, "The Boy and a Frog," by Elsie Ward Hering (1871-1923), who grew up in Denver. Along the west side of this section, the herb garden joins the scripture garden in an area known as the Gloria Falkenberg Garden, which was dedicated in 1992 in memory of the former DBG trustee, tireless volunteer, Guild member and herb enthusiast.

The herb garden more than doubled in size with the completion of the east extension in 1974, designed by noted Denver landscape architect Jane Silverstein Ries. Sigert Stein was the stone mason for the garden and the creator of the sundial in the center of this section, which was donated in memory of Mrs. Owen, designer of the west section.

In a secluded area surrounded by borders of shrubs lies an amazing diversity of useful and beautiful herbs in this garden of traditional design. The orderly arrangement of the beds is reminiscent of classic European styles, but the rustic arbor lends a Western flavor. This is a garden of practical utility.

The garden's inventory includes nearly 300 taxa of culinary herbs, medicinal herbs and dye plants. The majority are perennials, but some are annuals, biennials and bulbs. The display also includes tender perennial plants (not adapted to Denver's climate) that spend the winter months in a cool Denver Botanic Gardens greenhouse.

Since most herbs are species and not hybrids, the beds may appear to have a somewhat weedy look. Though lacking in a sophisticated ornamental appearance, these are some of the most useful plants in our collections. Among the most popular are those used—fresh or dried—to delight our senses in foods and beverages.

Herb gorden. Photo: Denver Botonic Gordens.

The species of herbs grown in this collection come from around the world and represent medicinal and culinary traditions from many cultures. Visitors to the garden often are surprised at the large variety of such plants that will grow in Colorado. The plantings encourage visitors to incorporate these useful plants into their own gardens.

The Herb Guild cares for and harvests a variety of herbs from this garden. The herbs are dried and sold at the annual DBG holiday sale and used to make DBG's famous herb vinegars.

Herb garden in 1973. Photo: Denver Botanic Gardens.

Herbs with a strong fragrance

Aloysia triphylla	lemon verbena
Artemisia abrotanum	southernwood
Mentha x *villosa*	applemint
Monardella odoratissima	mountain monardella
Pelargonium crispum 'Prince Rupert'	Prince Rupert lemon geranium
Rosmarinus officinalis	rosemary
Salvia elegans	pineapple sage
Satureja hortensis	summer savory
Tanacetum vulgare var. *cripsum*	curly leaf tansy
Thymus vulgaris 'Narrow Leaf French'	Narrow Leaf French thyme

Very decorative culinary herbs

Agastache foeniculum	anise hyssop
Allium sativum 'Elephant'	Elephant garlic
Lavandula angustifolia 'Hidcote'	Hidcote lavender
Mentha longifolia var. *himalayense*	Himalayen mint
Myrrhis odorata	sweet cicely
Ocimum basilicum 'Rubin'	Rubin basil
Origanum x *majoricum*	Italian oregano
Salvia officinalis 'Berggarten'	Berggarten common sage
Tagetes lucida	mint marigold
Thymus pulegioides 'Oregano-scented'	Oregano-scented thyme

Home Demonstration Garden

The home demonstration garden was dedicated in 1981. Its design and construction were made possible through the generosity of the Garden Club of Denver, whose members also help maintain the garden. Landscape architect Charles (Randy) Randolph created the design.

The gift of the home demonstration garden to Denver Botanic Gardens was made by the Garden Club of Denver to provide a garden specifically planned to illustrate imaginative gardening design and use of plants. The design ingeniously employs a variety of materials in pathway paving and retaining wall construction so visitors may compare them easily and choose their favorites.

Taken in its entirety, the garden represents a fascinating possibility for a landscape of a typically sized urban backyard that offers much interest. The garden has two seating areas for relaxation and outdoor entertaining. Ground covers are employed extensively in the various beds to provide greenery without the maintenance demands of a lawn. Various sun exposures provide a variety of habitats for plants.

The "bones" of the garden are provided by trees that are planted in groves, rows and as specimens. The lattice gazebo is an inviting structure that provides shade and serves as the focal point of the design. A tool cupboard/potting area and composting bin attractively provide the practical facilities needed in a garden.

Flowering perennials, annuals and bulbs are featured in four different locations. Each of the four beds creatively displays plants of just one color (or shades of color). One bed is for blue flowers, one for pink, one for yellow and one for only white. The garden also includes an area for growing vegetables and cut flowers.

A tranquil pool with a small, trickling waterfall attracts numerous birds to the garden. Careful attention to selection of plant species for this garden has resulted in a display that is beautiful in every season of the year. This garden is unique among DBG's gardens because its smaller scale permits easier translation to the home landscape.

Home demonstrotion gorden. Photo: Tim Ryan.

Worthy ornamental plants in the home demonstration garden

Aconitum napellus	monkshood
Acer saccharum	sugar maple
Anemone sylvestris	snowdrop windflower
Coreopsis verticillata 'Moonbeam'	Moonbeam tickseed
Kerria japonica 'Pleniflora'	Japanese kerria
Ligularia przewalskii	leopard plant
Quercus bicolor	swamp white oak
Quercus gambelii	Gambel oak
Rhamnus frangula 'Asplenifolia'	thread leaf alder buckthorn
Rhodotypos scandens	black jetbead

Japanese Garden

Shofu-en, the Garden of Pine Wind, was formally dedicated in June 1979. The nearly two-acre garden was designed by Koichi Kawana (1930-1990). He was professor of Japanese landscape architecture and Japanese art at University of California at Los Angeles and designed numerous Japanese gardens throughout the country, including those at Missouri Botanical Garden, Chicago Botanic Garden and Minnesota Landscape Arboretum.

Even to those untrained or uninformed about its subtleties, the Japanese gardening style is unparalleled at symbolizing man's harmonious relationship with nature and evoking introspective tranquility in the beholder.

To create an authentic Japanese garden in Denver, some compromises regarding "traditional" Japanese garden plant species have to be made. The Japanese maples, rhododendrons and azaleas that often are important elements in Japanese garden designs do not thrive here. Even the species of pine typically included in Japanese Gardens are seldom seen in this area.

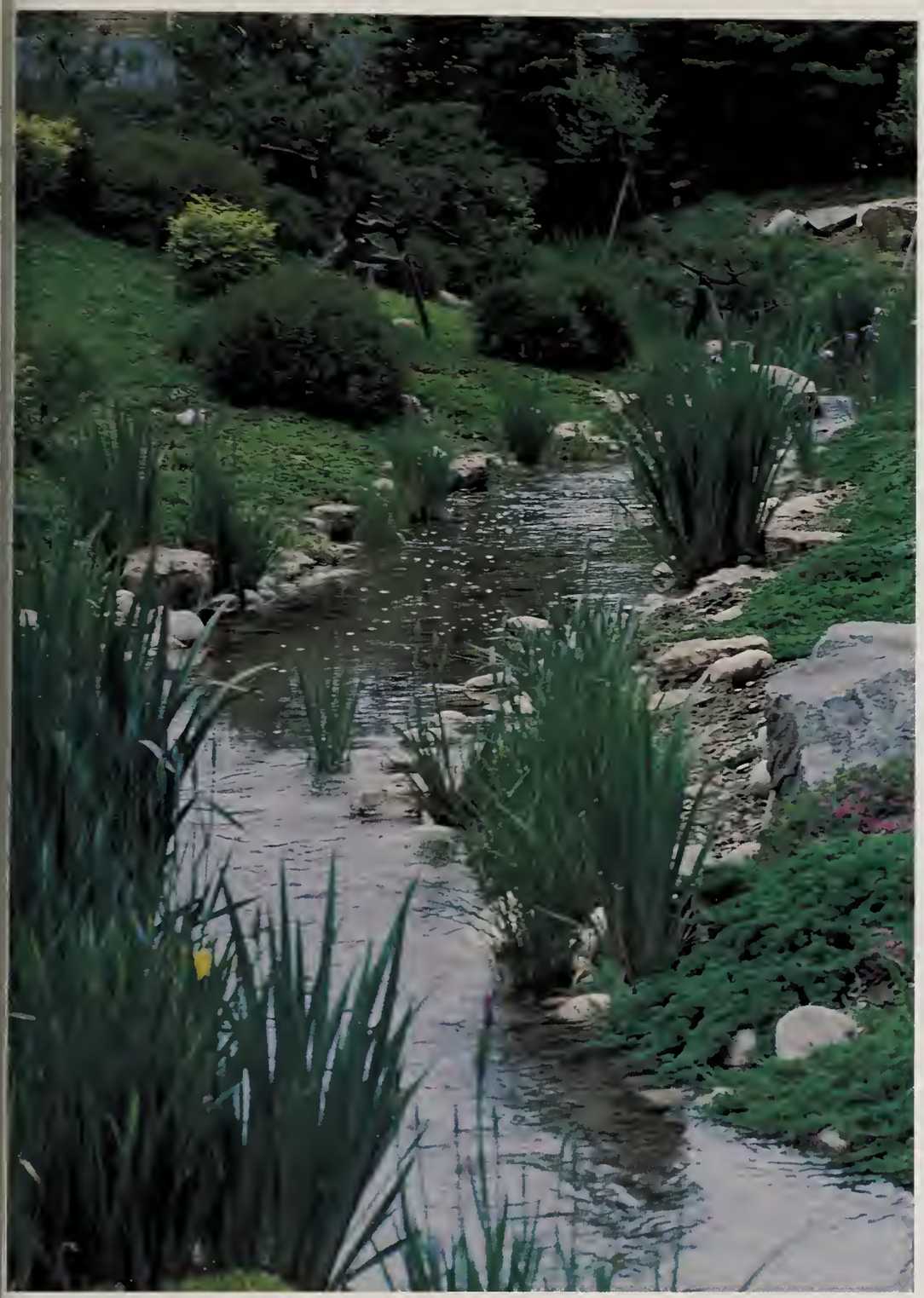
Nevertheless, a concept of great significance in Japanese gardens is that of greenness throughout the year, especially during the winter months. Symbolically, the pine is a basic structural tree in Japanese gardens and signifies longevity and happiness.

Fortunately, Colorado's rugged mountain climate in some locations produces trees with the twisted, weathered form appreciated in this gardening aesthetic. The more than 120 character ponderosa pines in this garden were collected by the Denver Bonsai Club at a site near Lyons. The trees are groomed constantly and pruned by DBG's Japanese garden specialist, who strives to maintain and enhance their shapes.

In this mile-high Japanese garden, some tough Asian maple species stand in for their less hardy Japanese cousins. Korean lilac, flowering plum and crabapple substitute for azaleas and cherry trees. Visitors may notice that herbaceous flowering plants play a significantly smaller role in the Japanese garden than they do in most Western garden styles.

Most of the rock in the garden was selected from a site near Golden and was carefully placed. The stone lanterns and teahouse are authentically Japanese. The latter was built in Japan, disassembled, shipped to Denver and reconstructed on site. The tea house is open periodically to the public who preregister to observe a Japanese tea ceremony, a beautiful and symbolic ritual.

The pond in this garden is the only pool at DBG that retains water in it all year. It is the home of our Japanese carp, known as koi, who live in it year-round. Plant identification display labels have been intentionally omitted from the Japanese garden so as not to detract from the garden's design.



Japanese garden. Photo: B. Whelon.

Plants suitable for a mile-high Japanese garden

Acer ginnala	ginnala maple
Betula pendula	European white birch
Cotoneaster lucida	hedge cotoneaster
Euonymus alatus 'Compactus'	dwarf winged euonymus
Juniperus procumbens	Japanese garden juniper
Lonicera x *xylosteoides* 'Clavey's Dwarf'	Clavey's Dwarf honeysuckle
Pinus mugo	mugo pine
Pinus ponderosa	ponderosa pine
Syringa meyeri	Meyer lilac
Thymus pseudolanuginosus	woolly thyme

Low Maintenance Garden

The low maintenance garden was designed by landscape designer and contractor Lew Hammer and completed in June, 1963. It was renovated in 1975.

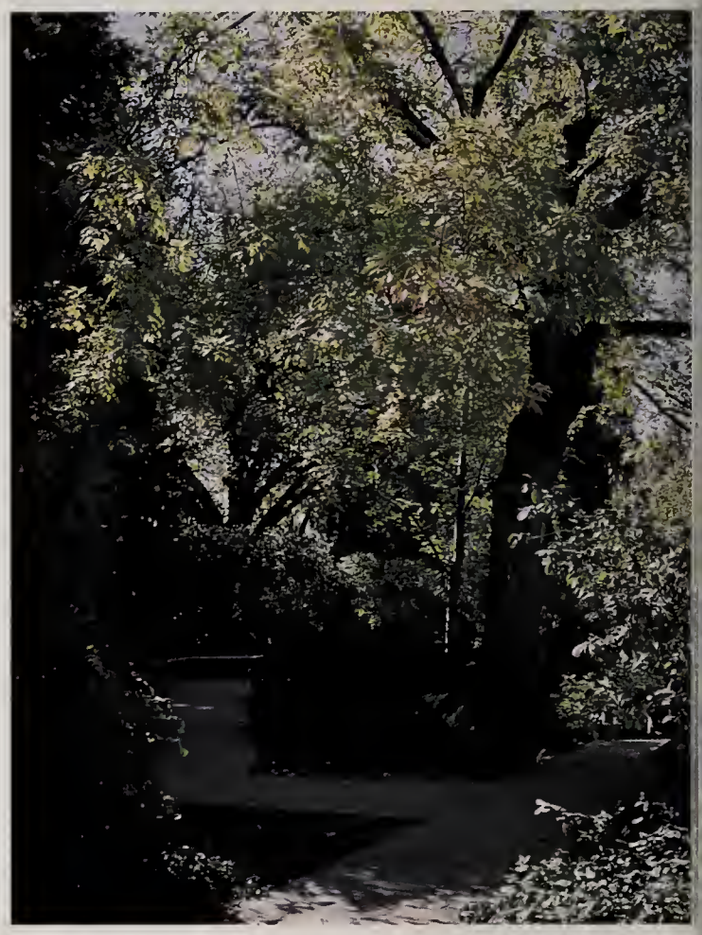
An attractive, low maintenance landscape is the goal of many homeowners. In this case it is demonstrated by an intimate no-turf planting. The garden surrounds an attractive deck built on angular lines. A dry stream bed crosses the garden.

Mature conifers, including several species native to Colorado, help frame the area. Among them are concolor fir, limber pine and Colorado spruce. Sizeable specimens of northern red oak and silver maple create the deciduous canopy overhead. The oak and a nearby mature Amur maple provide fall color in the garden.

This is one of Denver Botanic Gardens' shadier gardens and is instructive about plants suitable for such areas. Various species of shade-tolerant deciduous and evergreen shrubs, such as juniper, grape holly and euonymus, serve as ground covers in this garden. Although shade is not common in the native environment, as neighborhoods mature, gardens become shadier and a different selection of plants must be grown.

Viburnums are among the most shade-tolerant of landscape shrubs, and the genus is represented in larger numbers in this garden than anywhere else at DBG. The many viburnum species planted here are noted for various ornamental characteristics, including attractive foliage, flowers, fruit or fall color.

The unusual design of the boardwalk and deck in this garden is particularly noteworthy. Notice how the zigzag approach of the boardwalk meets the somewhat L-shaped, six-sided deck, and imagine the ordinary result a rectangular or square treatment would have produced. Benches at strategic locations on the deck complete the feeling of a cozy retreat.



Law maintenance garden. Phato: Ken Slump.

Ornamental, useful viburnums from the low maintenance garden

Viburnum carlesii	Korean spice vibu
Viburnum farreri	fragrant viburnun
Viburnum lantana	wayfaring tree
Viburnum plicatum f. *tomentosum* 'Shasta'	Shasta viburnum
Viburnum rufidulum	southern black ha
Viburnum trilobum	cranberry bush
Viburnum x *bodnantense* 'Pink Dawn'	Pink Dawn vibur
Viburnum x *burkwoodii*	Burkwood viburn
Viburnum x *rhytidophylloides* 'Alleghany'	Alleghany viburn

Ornamental Grasses

Denver Botanic Gardens pioneered the use of perennial and annual grasses in bedding and landscape designs. Many species thrive here for a good reason—the area originally was a grassland. Both native and exotic species are grown successfully and are particularly effective late in the growing season and during one of Colorado's longest and most beautiful seasons—"Indian Summer." A primary ornamental grass display bed is located north of the home demonstration garden and was first planted in 1993.

Ornamental grasses bring a form and texture to a garden's design that cannot be duplicated by any other plant. Most of the commonly cultivated species are fine textured and tend toward an upright habit. Their leaves and seedheads rustle softly in the breeze.

As with most large categories of plants, there is considerable variety among grasses. Some grass species are annual and some, perennial. Of the types commonly grown is this area, height varies from a foot or less to 10 feet and more.

Grass forms vary from rigidly vertical to fountain-like and arching. Foliage color varies both during the growing season and after frost in the fall. During late summer and fall the grasses come into their own and make their biggest contribution to the garden. Many species are ornamentally effective well after killing frosts and can stay attractive through most of the winter months.

The seed heads of ornamental grasses frequently are their most decorative feature. They may be full and plume-like or as spindly as a pipe cleaner. Color varies from pink to russet, green to white. Many seem to have a luster or almost prismatic quality in certain light. A number of grass species have seed heads suitable for drying.

Perhaps the most surprising information about ornamental grasses is how easy the majority are to grow. They are particularly suited to the periodic winds and potential hail of the regional climate. Most require average soils and thrive on limited irrigation, which makes them ideal garden plants.

Ornamental grasses display. Phata: Havey Productians.

Graceful ornamental grasses for the region

Calamagrostis x *acutiflora* 'Oredam'	Oredam feather reed grass
Deschampsia caespitosa	tufted hair grass
Erianthus ravennae	ravenna grass
Holcus lanatus	velvet grass
Miscanthus sinensis 'Silberfeder'	silver feather miscanthus
Molinia caerulea ssp. *arundinacea*	purple moor grass
Panicum virgatum	switch grass
Pennisetum setaceum	fountain grass
Seslaria autumnalis	autumn moor grass
Stipa gigantea	giant feather grass

Perennial Walk

For about 15 years, the walkway south of the entrance to the education building has been the site of a perennial border, being redesigned several times. Local enthusiasm for perennial gardening fostered Denver Botanic Gardens' desire to seek an updated version that could reflect the level of sophistication the style was achieving locally. The garden was designed by local horticulturists and authors Rob Proctor and Lauren Springer. In June 1997, the O'Fallon Perennial Walk was formally dedicated.

As a garden style, the traditional perennial border has become a classic favorite. Today's versions blend annuals, bulbs, grasses, vines and shrubs with herbaceous perennials into a tapestry of color and texture that changes constantly throughout the growing season.

The sophisticated plantings of the O'Fallon Perennial Walk have numerous lessons for the novice and experienced horticulturist alike. Although not mirror images, the borders are configured to complement each other. Blocks of various floral colors blend into one another as you stroll the borders' length.

Each side of the planting is flanked by a row of seedling Rocky Mountain junipers. Visitors with a particularly discerning eye may notice that the junipers have been planted on an angle which narrows toward the south. This "forced perspective" is used to make the borders appear longer than they actually are when viewed from the north.

A mixed shrub border has been planted in front of the junipers to provide a backdrop for the plantings. The shrubs provide structure to the plantings throughout the year and include species selected for seasonal displays of distinctive bark, foliage, flowers or fruit.

The varieties planted in these beds were selected for their ability to perform in this climate. Species that require excessive staking and grooming or copious amounts of water were avoided. Plant placement was determined not only by flower color, but also by the plant's height, form and texture. One of the designers' goals was to blend a variety of species to maximize the flowering season of the borders. From March through October the beds transform weekly as different plants burst into bloom.

O'Fallon Perennial Walk. Photo: Tim Ryan.

Hardy, exotic lilies from the O'Fallon Perennial Walk

Lilium x 'Adriane'	Adriane Asiatic lily
Lilium x 'Black Beauty'	Black Beauty oriental lily
Lilium x 'Copper King Strain'	Copper King Strain trumpet lily
Lilium x 'Heartfire'	Heartfire lily
Lilium x 'Jalapeno Fire'	Jalapeno Fire lily
Lilium x 'Pink Perfection Strain'	Pink Perfection Strain lily
Lilium x 'Red Velvet'	Red Velvet lily
Lilium x 'Santa Fe'	Santa Fe lily
Lilium x 'Star Gazer'	Star Gazer oriental lily
Lilium x 'Vulcan'	Vulcan lily

Pre-Columbian Gardens

Since the late 1980s, Denver Botanic Gardens has been developing, planting and expanding ethnobotanic displays featuring plants of the Aztec, Inca, Maya and Southwest Native American peoples. Most of the species are annuals. The plantings include food, fiber, medicinal, dye and ornamental plants, most of which are unique to these cultures and to the New World.

Some of Denver Botanic Gardens' most unusual outdoor displays are the pre-Columbian plantings of the Aztec, Inca, Maya and Southwestern native peoples gardens. These plots are instructive on a variety of levels.

Many of the more than 200 varieties of plants displayed in these gardens are grown from seed obtained from a few mail order seed sources that specialize in marketing "ancient" and traditional folk races of food crops from these American cultures. The gardens incorporate and demonstrate some traditional dryland agricultural techniques, such as sand hills, terracing and waffle beds, in the cultivation of these plants.

Flowering plants native to the New World add color to the display. Many popular garden species are natives of the Western Hemisphere. The ornamental display is augmented with agave, prickly pear, avocado, pineapple, bromeliad and other tropical plants that spend the winter months in DBG's greenhouses.

Although Colorado generally is not considered part of the American Southwest, our state's borders do include lands that were part of the ancestral Puebloan civilization. The way this culture developed a trading network so extensive and fed its citizens in such a marginal climate for agriculture still amazes and mystifies contemporary scholars.

According to accounts by the first explorers that describe the Aztec gardens in the central valley of modern day Mexico, an agricultural and horticultural technology existed there that was more advanced than anything comparable in Europe at the time. Courtyard, rooftop and floating gardens, vine-covered trellises, splashing fountains and intricate mazes are a few of the wonders the explorers encountered.

Perhaps most interesting is the number of food plants the ancient cultures of America have given to the cuisines of the world. Corn, chile pepper, tomato and sweet potato all are New World plants. The list also includes green bean, dried bean, squash, pumpkin, potato, avocado, pineapple, papaya, guava, peanut, cashew and chocolate.

Pre-Columbian gorden. Photo: Tim Ryon.

American annuals from the pre-Columbian gardens

Datura innoxia	thorn apple
Helianthus annuus 'Tarahumara'	Tarahumara sunflower
Ipomoea lobata	Spanish flag
Mirabilis jalapa	marvel of Peru
Nicotiana langsdorffii	Brazilian flowering tobacco
Phaseolus coccineus	scarlet runner bean
Salvia coccinea 'Lady in Red'	Lady in Red salvia
Spilanthes oleracea	salad cress
Tithonia rotundifolia	Mexican sunflower

Rock Alpine Garden

Perhaps the most notable of Denver Botanic Gardens' outdoor displays is the rock alpine garden. It is our most intensively planted—about 25 percent of DBG's plant inventory resides in this garden. The garden covers a bit more than an acre. It was dedicated in June 1981 and was designed by landscape architect Herb Schaal, vice president/principal at EDAW, a national landscape architecture firm with Colorado offices in Fort Collins and Denver.

Nearly 500 tons of five types of rock were used in its construction. The garden was designed to provide habitats similar to more than a dozen different high altitude environments based on slope, soil type, moisture and exposure. The climate controlled alpine house displays plants whose growing conditions are not met in the outdoor gardens. Rock alpine garden curator Panayoti Kelaidis has overseen the garden's development from its beginning.

Blend the traditional rock garden with a regional plant experiment station, throw in a dash of the perennial border and plants native to high elevations, and you've got an idea of the complexity that is Denver Botanic Gardens' rock alpine garden. Nowhere else at DBG exists such an intricate layering of plantings or intensive development scheme.

Recognized in 1997 by *Garden Design* magazine as the premier example of the art of rock gardening in North American public horticulture, the display has helped promote the utility and value of ground covers, all manner of perennials, dwarf shrubs and conifers as low maintenance, beautiful elements of a year-round garden. The garden is a demonstration of the time-honored method of gardening sometimes described as "plantsmanship," where plants are woven into a tapestry of foliage and texture, and color comes and goes in waves or pulses through the season.

The principal color display consists mostly of bulbs during March and April, with alpine plants taking the spotlight in May and June. Over the last decade, the garden's curator has concentrated on introducing new plants from monsoonal climates to provide summer color.

The Himalayas, Southwestern United States, northern Mexico and the high mountains of the Karoo and Drakensberg of South Africa are among such climates. In these areas the rainfall is concentrated during the summer months. Their native plants are triggered to bloom by summer's heat and rain, so they often flower in July, August and September.

Identifying and labeling the plants in this garden is no mean feat. Weeding in a garden of so many unfamiliar plants can be difficult, too. In spite of such travails, this garden has been and continues to be the "birthplace" of numerous species that are grown and displayed in this region for the first time. A number of them have moved from this garden to other DBG displays and into the regional nursery trade, as well.

Rock alpine garden. Phata: Panayati Kelaidis.

Panayoti Kelaidis' favorite alpine plants

Androsace sarmentosa	Himalayan rock jasmine
Aquilegia saximontana	Rocky Mountain columbine
Delosperma sphalmanthoides	pink cushion ice plant
Draba bryoides var. *imbricata*	Caucasian draba
Eriogonum caespitosum	cushion buckwheat
Gentiana acaulis	stemless gentian
Origanum 'Kent Beauty'	Kent Beauty oregano
Penstemon teucrioides	mat penstemon
Primula auricula	yellow alpine primrose
Zauschneria garrettii	fire chalice

Rose Garden

America's national flower is well represented by more than 250 different varieties, species or hybrids in the May Bonfils-Stanton Rose Garden at Denver Botanic Gardens. The garden was designed by EDAW landscape architect Herb Schaal and was dedicated in August of 1982.

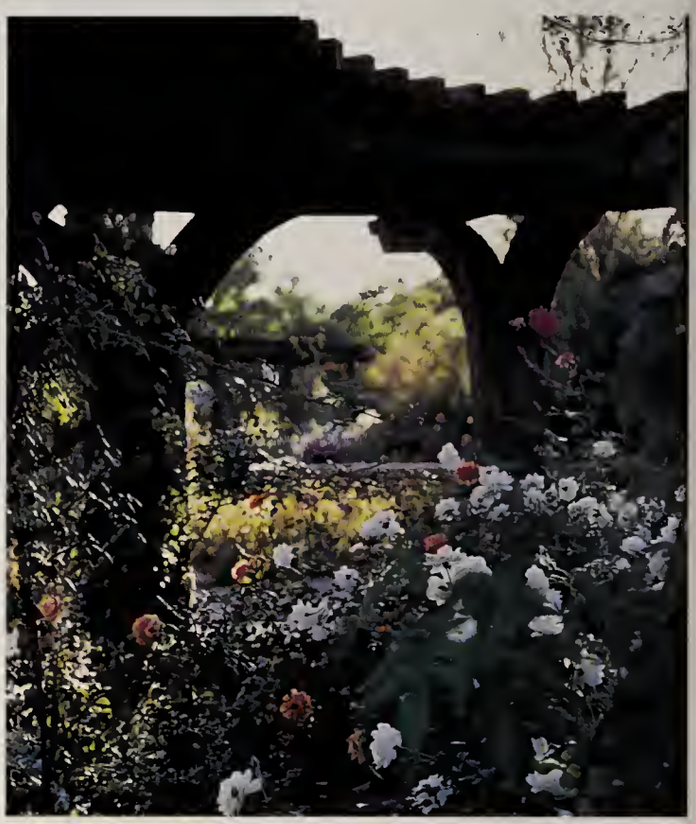
The rose garden occupies about a half-acre near the geographic center of Denver Botanic Gardens. The garden's various levels, entrances and sight lines provide opportunities to view the plants and flowers from a variety of vantage points. Within the garden, background shrubs, arbors, trellises and walls frame views and create intimate spaces.

In just a short walk through this garden, one cannot help but notice the large variety of rose types. The woody plants vary from charming miniatures, which are among the hardiest roses, to 10-foot tall shrub roses and vigorous climbers. Some roses are covered with blooms for a comparatively short part of the growing season, while others flower more or less continuously. The roses vary not only in flower color and shape of blossom, but also in petal count and scent.

Most gardeners grow shrub roses for their blossoms, of course, yet some varieties have additional ornamental characteristics. The thorniness of some types has an esoteric beauty, but the edible fruit, known as a hip, is colorful on some varieties throughout much of the late summer, fall and early winter. Some roses even have foliage with attractive fall color.

Rose classification is a somewhat daunting subject for the novice. The genus has been cultivated for at least 3,000 years, and extensive hybridization has been practiced for more than two centuries. At its most basic, roses may be sorted into one of three groups: contemporary or modern roses, old garden roses (from a classification system prior to 1867), and species and their hybrids or variations. There also are classifications based on habit of growth, such as climbers and shrub types.

A type of rose exists for nearly every garden. Colorado's bright sun and low humidity seem to favor many kinds of roses. Their variety and versatility have justifiably made them one of the most popular and symbolic plants in the world.



May Bonfils-Stanton Rose Gorden. Photo: Tim Ryon.

A bouquet of roses from the May Bonfils-Stanton Rose Garden

Rosa 'Amber Queen'	golden yellow, floribunda
Rosa 'Angel Face'	lavender, floribunda
Rosa 'Belle Story'	pink, hybrid tea
Rosa 'Dainty Bess'	pink, single, hybrid tea
Rosa 'English Miss'	pink, floribunda
Rosa 'Eyepaint'	red, single, floribunda
Rosa 'Fantin-Latour'	pale pink, centifolia
Rosa 'Golden Wings'	yellow, single, shrub
Rosa 'Paul's Himalayan Musk'	white, rambler
Rosa pomifera	pink, large hips, apple rose
Rosa 'Simplicity'	pink, floribunda
Rosa 'Sun Flare'	yellow, floribunda
Rosa 'Tiffany'	apricot pink, hybrid tea
Rosa 'William Lobb'	red, moss

Scripture Garden

The goal of the scripture garden is to interpret and display plants with Biblical reference. The original design for the garden was created by Denver landscape architect Jane Silverstein Ries. The garden was constructed with funding from the Coors Foundation and was dedicated in June 1981. The centerpiece is a ground level sculpture consisting of eight bronze medallions, four of which are Christian and four of which are Jewish symbols. These encircle a central medallion of alternating Christian Crosses and Jewish Stars of David. The sculpture was created by William F. Joseph.

The scripture garden is one of Denver Botanic Gardens' smallest, yet most intriguing gardens. For century after century, through many translations and rewritings, the Bible has been subjected to a number of interpretations and continues to fascinate scholars. There are various ideas about the plant references contained in its pages. DBG has strived to present an accurate interpretation of the plants that are described in the Bible according to the best of contemporary theories.

The garden's beds are arranged in the order of the Biblical texts from which the plants in them are referenced, beginning on your left as you pass through the arbor into the garden. Move clockwise about the perimeter, and end with the bed on the right side of the same arbor.

A number of the plants displayed in this garden are not hardy in Colorado. They are grown in pots which are sunk into the ground for the summer, but must spend the cold months in DBG greenhouses. Palm, pomegranate and fig are a few of these.

Even visitors uninterested in Biblical plants can enjoy the garden's simple and effective design. The multi-level plan is nearly bilaterally symmetrical with a reflecting pool on the lower level. The bed shapes are a beautiful blend of straight lines and curves. The buff sandstone used for the walkways and retaining walls provides a unity suited to the small space, its color evocative of the colors of the Holy Land. Benches for relaxed contemplation have been thoughtfully placed.

Scripture garden. Photo: Ken Slump.

High Plains scripture garden plants

Allium porrum	leek
Coriandrum sativum	coriander
Galium verum	our lady's bedstraw
Linum usitatissimum	flax
Mentha longifolia	mint
Ornithogalum umbellatum	star of Bethlehem
Prunus armeniaca	apricot
Ruta graveolens	herb of grace
Stachys byzantina	lamb's ears

Water Gardens

Denver Botanic Gardens has become one of the world's leaders in aquatic gardening and display of aquatic plants, a phenomenon somewhat unexpected in a semi-arid climate. This is due to regional gardeners' interest in the subject, coupled with the infectious enthusiasm of DBG's aquatic horticulturist Joseph V. Tomocik, who changes the design of the displays annually.

When the master plan was originally made for the outdoor gardens at Denver Botanic Gardens, an extensive waterway system was included to meander through the site. The system begins at the four pylons in the pool across from the entrance to the scripture garden. Through interconnected ponds offering a variety of water effects in both pools and falls, the water course travels westward where it widens to create the main water display pool. From here the water splashes over a waterfall into the Japanese garden and flows to the west pond, where it is recirculated.

Although the designers' goal was to create a refreshing atmosphere in sight and sound for DBG visitors, it is doubtful they imagined the extent to which the waterway system would be used for aquatic gardening. In recent years, nearly all of the pools along the water course have at least a few plants growing in them during the summer months.

The aquatic collection has grown to more than 450 different species and varieties, with more added each year. The peak water lily display is during late summer and early fall as the mature plants' foliage and blossoms carpet the pools. Both hardy and tropical varieties are grown.

Some of the most unusual plants are the "emergents"—those plants that grow in swampy areas or at the edges of ponds. These include

Water gorden pool. Photo: Tim Ryan.

grasses, sedges and a variety of flowering and foliage plants that can add height and textural variation to aquatic displays. Water canna is one emergent that is receiving increasing interest from water gardeners.

Water gardening is not the exclusive province of those with room for a pond or pool. Miniature water gardens can be created in nearly any container that holds water. Some very attractive examples of the whisky barrel size are displayed during the summer months in the area around the main aquatic display pool.

The DBG waterway system is drained during the cold months. Many visitors are curious to know where the aquatic plants spend the winter. The tropical water lily tubers are stored in our greenhouses. Hardy water lilies and aquatic plants either go into cold storage or are kept in water-filled troughs outdoors. Hardy aquatic plants are even stored under tarps outside.

Joe Tomocik's favorite water lilies

Nymphaea 'Albert Greenberg'	yellow-orange, tropical
Nymphaea 'Aquarius'	blue-violet, tropical
Nymphaea 'Arc-en-ciel'	pink, hardy
Nymphaea 'Colorado'	salmon, hardy
Nymphaea 'Denver'	buff, hardy
Nymphaea 'James Brydon'	red, hardy
Nymphaea 'Jennifer Rebecca'	crimson, tropical
Nymphaea 'Joey Tomocik'	yellow, hardy
Nymphaea 'Missouri'	white, tropical
Nymphaea 'Rhonda Kay'	purple, tropical

Water-smart Garden

Dedicated in September 1995, the water-smart garden is one of the more recent additions to the York Street complex. The garden was funded by Denver Water and MetroWater Conservation Inc. The design was by Colorado horticulturist and author Lauren Springer.

For years the sunbaked slope on the south side of the conservatory proved to be a difficult space to garden. Both the adjacent concrete walkway and the conservatory panels reflect additional heat onto the area, compounding the problem. The high traffic location needed an attractive and meaningful plant display, but attempts were never quite satisfactory and required extensive irrigation. Finally, Denver Botanic Gardens' horticulture staff got smart and decided to work with the microclimate instead of against it.

In 1994 Lauren Springer published her book, *The Undaunted Garden*. In its pages she entertainingly explores her frustrations at gardening in Colorado until she modified her gardening techniques and plant palette to suit the local climate. She was the perfect choice to design a garden for this site.

The garden conveys a sense of regional pride in its design and choice of plants, both native and not, that are adapted to our semi-arid climate. Flower colors and plant textures are skillfully combined. The planting is beautiful year-round and is particularly colorful during spring.

One of the ways that this garden is truly "water-smart" is that plants with similar environmental requirements are grouped together. The garden has three different soil types and an efficient irrigation system. Many visitors wonder how often the garden is watered. The truth is that it varies depending on weather and the age of the plant. Plants are watered more heavily during their first two years in the garden until they are well established. Fertilizer is seldom applied.

Do you notice a large number of plants in this garden with silvery or hairy foliage, reduced leaf size, succulent leaves or spines? These are water conserving adaptations commonly found on plants native to dry climates.

It may be worthwhile to note that while a garden of climatically adapted plants will save time on such garden tasks as staking, watering, pest control and fertilizing, there is gardening maintenance required for such things as deadheading, weeding and routine garden cleanup. This should not be viewed as a no-maintenance garden, and for that matter, there probably is not such a thing.

Water-smart garden. Phata: Tim Ryan.

Plants for seasonal and year-round interest from the water-smart garden

Allium karataviense	Turkestan onion
Artemisia tridentata	bigleaf western sage
Cytisus x *kewensis* 'Moonlight'	Moonlight broom
Dianthus x *allwoodii*	garden pink
Helictotrichon sempervirens	blue oat grass
Hemerocallis 'Corky'	Corky daylily
Penstemon strictus 'Bandera'	Bandera Rocky Mountain penstemon
Perovskia atriplicifolia	Russian sage
Oenothera macrocarpa spp. *freemontii*	Freemont's evening primrose
Marrubium rotundifolium	horehound
Salvia argentea	silver sage
Yucca filamentosa	spoonleaf yucca

Wingsong Garden

The wingsong garden was developed to demonstrate gardening attractive to birds in the urban environment. It was dedicated in September 1987, and was designed by former DBG staff member Gayle Weinstein.

The wingsong garden berm is a planting with a purpose—to provide food, shelter and nesting sites for birds. In recent decades, plant breeders have provided the public with ever "cleaner" trees and shrubs, i.e. thornless, fruitless and even flowerless cultivars. Although these "advancements" dubiously may ease garden cleanup, such attributes provide sustenance for many kinds of wildlife and give each plant species its unique character.

In a sense, these antiquated attributes are the essence of this garden. One of the first requirements of plantings to attract birds is a source of food, so the garden includes species with seeds and fruit that birds are known to favor. Horticulturists planning similar gardens should plant species that allow for fruit to ripen in various parts of the season in order to provide food for as much of the year as possible.

The most popular shelter and nesting sites for most bird species are in densely twigged large shrubs, small trees and evergreens. Nests are generally built in secluded locations between five and 15 feet off the ground. Twig arrangement needs to be thick enough to deter predators, yet must allow for an easy escape. Thorny plants are particularly favored. Plant foliage must protect the nest from sun and rain, as well as hide it from view.

Maintaining a garden a bit less stringently can help encourage birds, too. If you avoid deadheading every blossom, seed and fruit may be produced that will provide food for birds. Reduce pesticide usage so birds can have an opportunity to control insect pests for you.

One requirement frequently overlooked in plantings for birds is a convenient source of water in an open location safe from predators. Birds need water for drinking and bathing, and it must be changed frequently. In this garden, some large rocks with concave faces provide natural basins for this purpose, and there is a small pool at the west end of the planting, as well.

Wingsong garden genera of small trees and shrubs that attract birds

Amelanchier spp.	serviceberries
Berberis spp.	barberries
Crataegus spp.	hawthorns
Juniperus spp.	junipers
Lonicera spp.	honeysuckles
Prunus spp.	plums/cherries
Ribes spp.	currants/gooseberries
Rosa spp.	roses
Rubus spp.	berries/raspberries
Sambucus spp.	elderberries
Sorbus spp.	mountain ashes

Wingsong gorden. Photo: Denver Botonic Gordens.

Chapter 2

Behind-the-Scenes

Propagation greenhouse. Photo: Wendy Tucciarone.

Plant Propagation

Out of the public eye, a mini-factory at Denver Botanic Gardens quietly produces up to 65,000 plants each year. DBG's plant propagation department grows plants for countless uses, including vegetables and annuals for the outdoor display gardens; trees, shrubs and perennials for the permanent collections; display plants for the changing exhibits in the lobby court; complimentary plants given to new members; and indoor and outdoor plants offered as annual dividends to members.

Special plant production projects frequently are processed through the department as well. Recent examples include starting plants for the Cherry Creek Greenway Foundation's Punt the Creek site and a prairie ecosystem restoration project at the Rocky Mountain Arsenal.

Plant production is necessary throughout the year, with peak demand occurring during March and April. A carefully planned production schedule maximizes DBG's limited production space. Propagation requirements include supplying the correct temperature, moisture level, growing medium and amount of light for each species. Most methods of plant propagation are employed, but seed and cuttings are most commonly used.

Seeds are not necessarily ready to plant and grow as soon as they are received. Often some sort of treatment is required in order to get them to germinate. Common treatments include cold storage for periods of weeks or months and seed coat scarification—scratching the seed coat with abrasives or acids.

The success rate in starting new plants from cuttings taken from their stems, leaves or roots varies considerably among species. The time of year that the cuttings are taken can be the deciding factor. Additional treatments may include cool storage, overhead mist, supplemental heat at the root zone and application of rooting hormone, to name just a few.

It is interesting to note that plant propagation includes not only new plants coming to DBG's temporary displays and permanent collections, but also the propagation of existing plants at the facility. Each fall, seed and cuttings are harvested from annuals and tender perennials that will be used in the displays the following year. Plants in the permanent collections that are in a state of decline or that have to be moved or destroyed for various reasons are also periodically propagated so they are not lost from the collections.

Although most of the propagation methods employed are fairly straightforward, DBG's plant propagator frequently is faced with the task of starting seed or rooting cuttings from rare or uncommon species for which the best techniques are not readily known. In such cases, library research is required. Occasionally there is no information available and the propagator must make an educated guess based on the genus or family to which the plant belongs and the part of the world in which it grows. Records are kept in these cases for future reference.

The complexities of the botanic world become particularly apparent in the realm of plant propagation, yet it is one of the most essential ongoing activities at a botanic garden.

Plant Records and Labeling

Tracking and identifying the plant collections at Denver Botanic Gardens is continuous. It is remarkable how plants seem to move about, disappear from and reappear back in their presumed locations! Also, an axiom of public gardening is that the plant that visitors most want to know about is the one without a label. Nevertheless, it is the job of the horticultural staff, with assistance from DBG's plant records department, to tackle these problems.

Each new plant or group of plants accepted into DBG's permanent collections is called an accession. Information on each new accession is supplied to the plant records department by the horticultural specialists of the various divisions of our permanent plant collection. Information supplied by the horticultural specialists includes the plant name, number of plants received, date received, source of the plant and its location at the institution. The plant's correct name is checked by our plant records department, and the information is entered into our database.

The correct plant name to use for each species is subject to some debate. Although the goal of scientific nomenclature is to unify and simplify the naming of plants and animals, at times the opposite is true. Due to the rules of nomenclature and the taxonomic reclassification of plants, "official" name changes occur with some frequency. DBG takes a conservative approach to name changes because we feel it is important that our visitors can reference information on the plants they see in our gardens. Using the most avant-garde name can make this difficult, if not impossible—it can take the popular plant literature years to catch up on these modifications.

DBG uses a plant records database known as BG-BASE. "BG" stands for "Botanic Gardens" because it was developed specifically for the use of public horticulture. More than 80 institutions worldwide use some version of this database.

The number of accessions added to the permanent collection varies each year. In the last several years DBG has averaged about 2,000 new accessions annually, but the number varies depending on garden development or redevelopment and on plant and seed collection trips.

Plants are deaccessioned when they die or may be removed from the inventory at the discretion of the horticultural specialists. DBG's current number of living accessions is about 20,000. It is impossible to determine how many plants are in the permanent collection. Any accession may contain multiple plants, so nobody knows the exact total. In fact, numerous accessions contain indistinguishable numbers that are identified in the database simply as "mass." Inventories are conducted of each garden to verify which species continue to survive.

Plant labeling is the bane of public gardens. Because botanic gardens often display plants that are uncommonly seen, it is expected that visitors will want to know their names. Although some visitors suspect that we want to keep the plants' identities a secret, that couldn't be further from the truth. At times we're convinced that aliens remove our labels by the dark of night, but be assured that we produce and place thousands of labels on the grounds each year.

The display labels are engraved on-site. Information on our "standard" label includes the plant's scientific and common names and the plant family to which the genus belongs. In many cases, the plants we display are unusual enough that they do not have a common name. Some labels, particularly in the rock alpine garden, identify the plant's native range.

Over the course of time, the activities involved in the recording, labeling and inventorying of our permanent plant collections comprise important "behind-the-scenes" activities that not only help distinguish a botanic garden from a public park or display garden, but also provide a passive form of applied research on the array of plants that will survive in the region.

Plant Select®

The pride of Denver Botanic Gardens' applied research program is Plant Select®, a plant evaluation and introduction program. The cooperative venture between DBG, Colorado State University and the Colorado green industry was started in 1988. Since its inception a number of DBG staff have contributed time and expertise to the success of the project.

The program was undertaken to develop and promote ornamental plants uniquely suited to the climate and soils of the region. To this end, Plant Select® evaluates, endorses, selects and introduces all manner of landscape plants, including trees, shrubs, perennials and annuals.

Plant Select® is continuing the ongoing process of selecting superior ornamental specimens of some woody plant species, including bigtooth maple and rabbitbrush. The slow growth rate of woody plants and the time required to reproduce them in marketable sizes dictate that this will be a long-term project. Eventually, it is hoped that evaluation efforts will result in original introductions or improved clones of these and other woody plants.

At present, Plant Select® is preparing for its second year of promoting plant recommendations and introductions for the region. Most of these are herbaceous species, but there are some woody plants, too. Many of the plant varieties in this promotion program have been included as a result of DBG staff observations of plants in our displays, trials and gardens over a period of years. We have been fortunate to obtain interesting and unusual plants through horticultural exchange as well as through our efforts in plant exploration and seed collection. Plant Select® expects to add several new plants to its growing roster of recommendations and introductions annually and is planning several years ahead to assure retail availability of each year's winners as they are announced.

The first year's winners were announced and promoted by Plant Select® in the spring of 1997. The plants were enthusiastically marketed and sold by area nurseries. One of the most rewarding aspects of Plant Select® is the national attention it has generated. Avid horticulturists are always seeking new and different plants, and many of the selections promoted by the program thrive in other regions, too.

Through the efforts of Plant Select® it is hoped that DBG will continue to contribute to the development of the horticultural style of the region and broaden the plant selection available to both hobby and professional horticulturists.

Plant Select® 1997 selections

Agastache rupestris	sunset hyssop
Daphne x *burkwoodii* 'Carol Mackie'	Carol Mackie daphne
Salvia argentea	silver sage
Veronica liwanensis	Turkish veronica
Viburnum x *rhytidophylloides* 'Alleghany'	Alleghany viburnum

Plant Select® 1998 selections

Buddleia alternifolia 'Argentea'	silver fountain butterfly bush
Delosperma floribundum 'Starburst'	Starburst ice plant
Gazania linearis 'Colorado Gold'	Colorado Gold hardy gazania
Osteospermum barberiae var. *compactum* 'Purple Mountain'	Purple Mountain sun daisy
Osteospermum 'Lavender Mist'	Lavender Mist sun daisy
Rhynchelytrum nerviglume 'Pink Crystals'	Pink Crystals ruby grass

Seed Exchange

A little known but important activity among the fraternity of public gardens worldwide is their cooperative seed exchange program, commonly referred to as *Index Seminum* (Latin for "seed list"). This is truly a remarkable partnership between public gardens, arboreta and university departments in many nations, and it operates at minimal costs to all parties involved.

Participating organizations publish a list, usually annually, of the plant species from which they have collected seed that they are willing to supply to other botanic gardens and similar institutions. The number of species listed may be as low as a dozen or two, while some gardens mail out booklets that contain literally hundreds, if not thousands, of offerings. The seed frequently is collected by the institution's botanists in natural habitats, so information is supplied on the particulars of the seed's location site. Seed from cultivated plants in the garden's collection may be offered, too.

Each *Index Seminum* catalog or list contains an order form for the institution to return with its preferences indicated. The plants are ordered by number, and the offerings are listed using the Latin names of the plants—thus language barriers are easily crossed.

The amount of seed returned to the requesters typically is quite small for several reasons. It is unquestionably easier to mail a packet of just a few seeds, and if numerous species are requested, their bulk can add up. Also, as the seed often is collected in the wild from plants that may not be plentiful, a modest amount of seed is usually gathered. The goal of the suppliers is not to provide enough seed for an entire display, but to hopefully enable the requesting institution to produce from one to a few plants. Very small, fine seed may be shipped in larger quantity than larger seed.

Of course, it is the ability of many types of seed to remain viable for long periods of time that makes such an exchange possible, but some institutions go to considerable lengths to provide viable seed from species with shorter longevity. Denver Botanic Gardens has, at times, received seed carefully packaged in moist media to help ensure its survival—quite remarkable, considering that the only expense was the postage required to send our request.

A surprisingly large percentage of our plant collection has been obtained in this manner. In some of our gardens that feature unusual and exotic species, such as the rock alpine garden, one-third of the species are received in this way.

Though *Index Seminum* is highly successful, there are no guarantees. The seed is supplied on a first-come, first-served basis. DBG probably receives seed for about half of the species requested. When the seed is received it is quickly forwarded to the plant propagator, who researches its proper treatment for germination. For various reasons, not all seed germinates, and on rare occasions, DBG has produced plants from seed that apparently was mislabeled.

Nevertheless, you can't beat the price, and the *Index Seminum* program provides botanic gardens with the opportunity to grow and test new plants from the world's biggest and most complete catalog of seeds.

Applied Research at Denver Botanic Gardens

What is a botanic garden? At its most basic, it can be defined as a collection of plants that are kept for the purposes of scientific study, education and exhibition. Many public gardens also engage in either "pure" or "applied" research. Pure research involves a strict scientific method and procedure. Applied research often has a more informal approach.

One applied research activity that most botanic gardens undertake is the cataloging of their collections. This activity, even if in a passive way, amounts to research of plant survival and adaptability in a particular locality.

Beyond this, Denver Botanic Gardens has taken an active approach to other kinds of applied research. Although formal trial beds are not currently part of the scheme at the York Street gardens, DBG does seek out and acquire new species and varieties for testing in the permanent plantings each year. We also undertake short term projects on applied topics, such as a recent three-year evaluation of chrysanthemum varieties.

DBG participates in the All-America Selections program (AAS). AAS is a 65-year-old program that recognizes outstanding new flower and vegetable varieties per the results tabulated from their 31 flower judging locations and 26 vegetable judging locations across North America. DBG is an AAS display garden and features the winners for the three most recent years in our summer plantings.

Another testing program in which DBG participates is NC-7, a tree and shrub testing program managed by Iowa State University at Ames between seven North Central states. We are a test site for the Hardy Fern Foundation and, perhaps surprisingly, a designated arboretum of the American Holly Society.

Our vegetable garden is another area where we test plants. Each year the mix of varieties is new. In recent years we've grown hundreds of chile pepper varieties for comparison — a plant particularly suited to a regional trial and an excellent link to the pre-Columbian gardens.

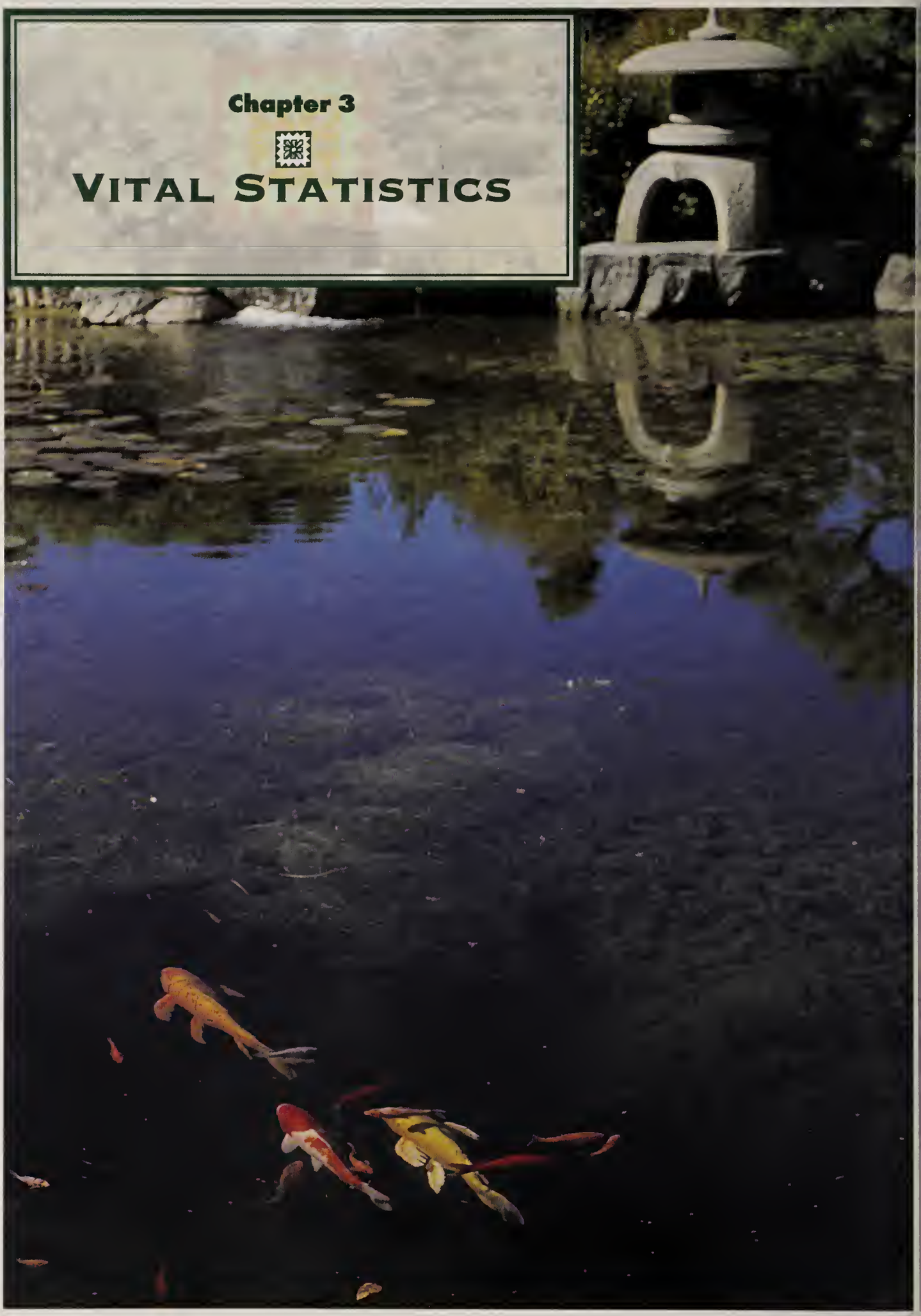
Ongoing plant evaluation at DBG also occurs in the All-America Rose Selections Inc. test garden. Each year DBG receives four plants of about 50 new rose varieties to grow and evaluate over a period of two years. The plants are identified only by number and classification. DBG's evaluator's critiques are combined with those of about 25 other test sites to compile the annual AARS awards.

DBG's botanists and horticulturists grow a limited number of plants "behind the scenes" in a few small areas at both the Chatfield Arboretum and York Street sites. These plants usually are obtained from seed exchange, purchased from regular commercial sources or collected during plant collection expeditions. Those that pass muster quickly find their way into our public displays.

One such display area is a recent planting at the site formerly occupied by the turf trials, near the main water lily display pool and the vegetable display garden. Trees and shrubs moved from the romantic gardens construction site provide a variety of habitats for shrubs and perennials that are being tested and evaluated.

Chapter 3

Vital Statistics



Japanese garden. Photo: Ken Slump.

Vital Statistics

Now that you've read all about our outdoor gardens, test your recollection of interesting facts—and add a few others to your knowledge. (All facts are current, as of fall 1997.)

Denver Botanic Gardens

On Feb. 3, 1951, the Botanical Gardens Foundation of Denver was incorporated. Denver Botanic Gardens was first located in City Park near the Denver Museum of Natural History. Within a few years the organization had built up impressive ornamental tree, shrub and iris collections and installed an alpine garden and a pinetum. The site fell prey to vandalism, so a search for a new site began.

In 1959 the horticulturists moved to DBG's present site. The large Normandy house at the corner of Ninth Avenue and York Street (the Botanic Gardens House) served as the headquarters, and the abandoned Mt. Calvary Cemetery offered 18 acres of open land. On Sept. 20, 1959, the new facility was dedicated, and since then many gardens and plantings have been developed.

Construction of the Botanic Gardens House (that serves as an administrative building) was completed in 1927. In 1958 the residence was donated to DBG. In 1973 the Botanic Gardens House was designated a Denver landmark by the Denver Landmark Preservation Commission in recognition of the building's outstanding architecture and value.

Architect Victor Hornbein, who designed the tropical conservatory, promoted the idea of a grounds development scheme that was as avant-garde as the conservatory. As a result, landscape architecture firm EDAW was chosen to design many of the outdoor gardens because of the firm's modern or nonclassical approach to landscape design. The berms (grassy mounds) and the sunken amphitheater were designed to reflect the prisms of the conservatory.

Look forward to an upcoming issue of *Mountain, Plain and Garden* that will highlight DBG's exciting history.

Chatfield Arboretum

Since 1975, Chatfield Arboretum has been leased from the U.S. Army Corps of Engineers and managed by Denver Botanic Gardens. The Arboretum hosts two 19th century farms and a one-room schoolhouse.

The historic farm, originally homesteaded by Frank Hildebrand in 1866, is on the National Register of Historic Places and preserves a valuable record of early Colorado farm life. In its original state it consisted of a farmhouse, summer kitchen, outhouse, wood shed, bunkhouse, ice house, garage, chicken house, blacksmith's shop, granary, field structures, carriage barn, milking barn and stable.

The more recent buildings of the former Green farm have been renovated to house administration offices, a small classroom and a maintenance shop. Deer Creek School, a one-room schoolhouse dating from the 1870s, has been restored and now is used as the Visitor Center.

Acreage
York Street site: 23 acres
Chatfield Arboretum: 700 acres

Size of staff
York Street site: 72 full-time, 15 part-time, 11 seasonal, 10 interns
Chatfield Arboretum: 5 full-time, 1 part-time, 1 seasonal

Size of Board of Trustees
45 (including ex-officio trustees)

Volunteers
Number of volunteers: 1,600
Number of hours volunteered in 1996: 80,700

Size of Membership
13,000

Annual attendance
York Street site: 328,000
Chatfield Arboretum: 28,000

Garden Stats
Average number of chile pepper varieties planted each year: 70
Number of taxa on grounds
  York Street: 8,710
  Chatfield Arboretum: 780
Number of spring bulbs planted each year: 25,000
Tons of rock in rock alpine garden: nearly 500
Tons of stone in the Japanese garden: more than 300

Building Stats
Size of Boettcher Memorial Conservatory: 160 feet long by 72 feet wide by 51 feet high (12,800 square feet of floor space)
Size of Marnie's Orchid and Bromeliad Pavilion: 1,600 square feet
Number of panels in Conservatory: 408
Size of production greenhouses: 18,000 square feet
Size of indoor display space: 14,900 square feet

Peak blooming seasons

(dependent on annual weather)

Minor bulbs	April 1 to May 1
Perennial border	April 1 to Oct. 15
Spring flowering bulbs	April 15 to May 15
Spring flowering trees	April 20 to May 10
Viburnums and lilacs	April 20 to May 15
Rock alpine garden	April 20 to June 1
Vegetable garden	May 1 to Oct. 31
Bearded iris	May 15 to June 15
Old garden roses	May 15 to June 15
Peonies	May 15 to June 15
Daylilies	June 15 to Aug. 15
Modern hybrid roses	June 22 to July 10
Lilies	July 1 to Aug. 1
Water lilies	July 15 to Sept. 15
Summer annual displays	July 20 to Oct. 1
Ornamental grasses	Aug. 15 to Oct. 15
Roses	Aug. 20 to Sept. 10

Water-smart garden. Photo: Tim Ryan.

Helen Fowler Library

Helen Fowler (1879-1960) was a local nursery owner who donated a large collection of books to the library. The library was housed at 1335 Bannock until 1960, when DBG moved to its present site. It opened at its current location in 1971. The library features the region's most comprehensive collection of botanical and horticultural books, periodicals, video tapes, pamphlets, nursery and seed catalogs and other materials. It circulates to DBG members and participates in "Interlibrary Loan" with other libraries.

Circulation: 16,250
Number of books: 25,000
Number of periodicals: 600
Number of video tapes: 125
Number of pamphlets: 5,000
Number of seed and nursery catalogs: 800

Major DBG Events

Botanical Illustration Show, February
Plant and Book Sale, May
Summer Concerts, June through September
BirdHaus Display, June and July
Pumpkin Festival, October
Holiday Sale, November
Blossoms of Light, December

Affiliated plant societies:

African Violet Society of Denver, Chapter 1
American Iris Society
Colorado Cactus and Succulent Society
Colorado Mycological Society
Colorado Native Plant Society
Colorado Water Garden Society
Denver Orchid Society
Denver Rose Society
Gardeners of America, Denver Chapter
Gloxinia Gesneriad Growers
Herb Society of America
High Country Judges Workshop
Ikebana International, Chapter 66
Mile High Daylily Society
Rocky Mountain Branch of the American Begonia Society
Rocky Mountain Chapter of the North American Rock Garden Society
Rocky Mountain African Violet Council
Rocky Mountain Bonsai Society
Rocky Mountain Koi Club
Rocky Mountain Regional Orchid Judging Center
Ultra Violet Club

(For information on contacting any of these plant societies, call DBG, 303-331-4000.)

Denver Botonic Gordens in the lote 1960s. Photo: Denver Botonic Gordens.

A Look Forward

Whew! So many gardens, so many plants, so much historical perspective. You may ask what more can be done? We view gardens as being very dynamic. At the present time, the southeast corner of the grounds is being renovated into a quartet of gardens. These gardens, called the romantic gardens, will feature plants, structures and water combinations that will be sensually enticing.

Water typically is featured in romantic gardens as quiet pools, fountains or subdued waterfalls. The visual impact of water and the sound of rushing water are mood-altering and especially welcome in our semi-arid climate. The waterway garden in the romantic gardens complex is modeled loosely after the water canal and wall creations of Luis Barragon, a noted Mexican landscape architect. This garden will feature an entry court, off the south end of the O'Fallon Perennial Walk, with 8-foot stucco walls, a quartet of matching ornamental trees, a smattering of ceramic tiles and wrought iron panels that flank two of the three entryways.

The water canal will begin as a smooth, sheeting waterfall at the east side of the entry court and flow toward Anna's Overlook, giving the illusion that it is connected to the existing waterway. The water canal will be flanked by the 8-foot stucco walls. A series of specimen oval-shaped columnar trees along the south side will be the focal point of the water canal area. They will cast symmetrically shaped and spaced shadows across the walk, canal and north wall that will be particularly prominent during fall, winter and spring, when the sun is lower in the sky.

The courtyard garden will be the focal point of the east side of the romantic gardens. At its center will be a diamond-shaped plaza composed of alternating green and buff colored stone. Flanking the plaza will be two octagonal pavilions with green tiled roofs, stucco exterior finish and brick accents, reminiscent of the Botanic Gardens House. The south end will have a small alcove with a feature element as a focal point from the O'Fallon Perennial Walk.

The remainder of the courtyard garden, east of the diamond-shaped plaza, will feature containers with seasonal plantings and small trees and will be the foyer for the proposed temperate greenhouse. Perennial, shrub and tree plantings will provide a visual screen to the east.

In the plant world flowers, fruits, bark, roots, leaves and stems have fragrances that are alluring, intriguing, stimulating, mood setting and more. The original concept for a fragrance garden at DBG dates back to 1990, when a design and plant list were created by EDAW in Fort Collins. In 1992, the concept was recast by Environmental Planning & Design (EPD), Pittsburgh, Penn. This new design will feature a central oval turf area surrounded by ground level beds and raised planters, a pool for water lilies, arbors for vines, walls and a fence for espaliers. A gardenesque brick walk, like that of the perennial walk, will provide an informal pathway through the garden. The retaining wall of the raised planter will provide seating.

The Hildreth Shade Garden is named in honor of Dr. A.C. Hildreth, DBG's first director. Nestled just south of the fragrance garden and east of the herb garden, it will feature native shade-tolerant plants.

In the not too distant future we plan to install a children's garden that will be about three-quarters of an acre in size and located between the daylily and vegetable gardens. It will feature plants grown as topiaries and structures that are engaging, challenging and stimulating for children. A classroom also will be featured for indoor and outdoor teaching opportunities.

As you can see, we are continually on the move, trying to increase the diversity of our living plant collections, always keeping in mind our mission of displaying horticulture in the Rocky Mountain region.

James E. Henrich
Director of Horticulture

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- Free admission to Denver Botanic Gardens and Chatfield Arboretum.
- One year of *Green Thumb News*, with gardening tips for Colorado and events and activities of Denver Botanic Gardens and Chatfield Arboretum.
- *Mountain, Plain and Garden* magazine, twice a year, with articles of lasting interest to plant lovers in the Rocky Mountain region.
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One membership card, admits one.

☐ The Botanist Club, *$120*
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☐ The Conservator's Society, *$240*
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Signature _____

Phone _____

Return this form with your payment. Questions about membership? Call 370-8029.

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by Susan Eubank, Senior Librarian, Denver Botanic Gardens

Here is an eclectic sampling of items authored by those associated with our gardens throughout its history. These and more can be found in Denver Botanic Gardens' Helen K. Fowler Library.

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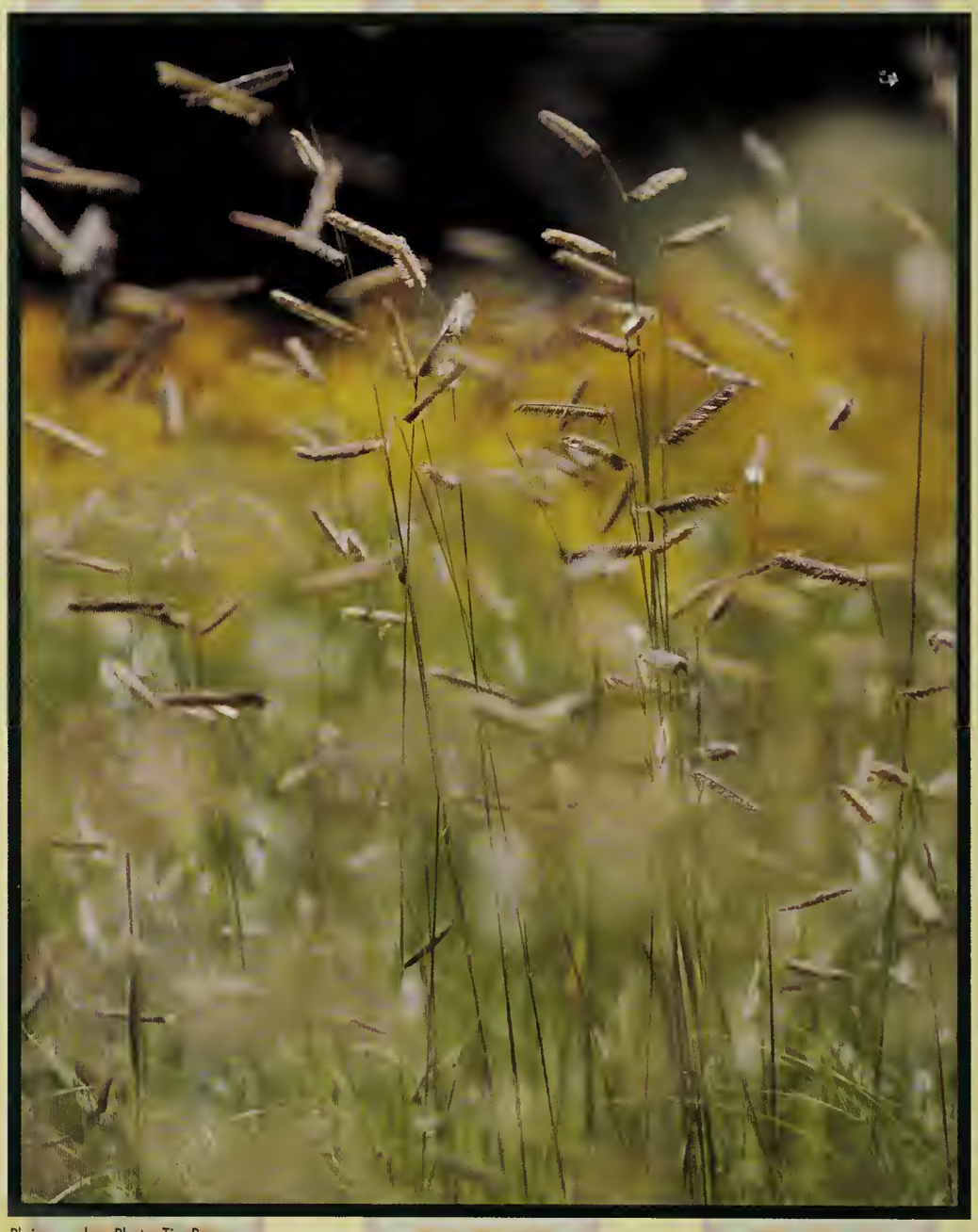

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